Ancient Economic Complexity and Adaptation in the Semi-Arid Highlands of Jordan: A Zooarchaeological Study of the Early Bronze Age Through the Ottoman Period at Tell Madaba

By

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ABSTRACT

This dissertation examines and compares animal utilization by the peoples who inhabited Tell Madaba, a site located along the fertile plains of the Central Jordanian Plateau that has maintained a continuing urban character for some 5,000 years, during seven historical periods: the Early Bronze Age, the Iron Age II, the Late Hellenistic Period, Early Roman/Nabataean, Byzantine, Late Byzantine/Early Islamic, and the Ottoman period. The primary research presented in this dissertation focused on a large faunal assemblage excavated between 1996 and 2002. Analysis of these remains in their archaeological contexts, in combination and comparison with data from neighboring sites, was used to identify the adaptive economic strategies and lifeways at Tell Madaba throughout each occupational phase. The analysis involved assessing the relationship between producers and consumers in addition to the variation in animal production systems visible within the distribution of species, ages, and carcass parts. A general review of ethnicity is also presented and illustrates the difficulty in using presence/absence of particular species as ethnic markers. Most likely, pigs at Tell Madaba represent socio-economic differences during the various occupational phases.

Tell Madaba appears to have been a large urban center during each of the occupations studied here. However, subtle shifts in size and population are evidenced in the historical literature and previous survey and archaeological work. These shifts are also detectable in the animal production system over time. The results presented here reveal differences in animal utilization between several of the occupations, which also coincide with changes in the geopolitical climate and population, along with political

instability. Changes in the animal production system are detected between the Early Bronze Age and the Iron Age, as the city rebuilt following the collapse of most urban cities and towns following the Late Bronze Age. Intra-site comparisons of the Iron Age II show that occupants in different areas of the site had differential access to species, carcass parts, and age groups. After an extended period of sparse occupation following the Iron Age II, reoccupation and rebuilding efforts began to occur during the Late Hellenistic Period resulting in a slight increase in agriculture and more reliance on by-products from medium-sized mammals. By the Roman period through the Ottoman agriculture increased significantly, while fewer sheep were available for food and goats increased in importance, sustaining an animal production system reliant on dairy and other by-products. Based on the limited change in the physical climate during these time periods, these shifts are a direct result of the adaptive strategies implemented within the animal production systems in order to sustain the occupants during various levels of occupation, rebuilding efforts, and social and political climates.

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CHAPTER 1
INTRODUCTION

This dissertation explores the potential of anthropological and zooarchaeological methods at Tell Madaba in west central Jordan, focusing on distribution patterns within species, bone elements, and age profiles to investigate adaptive strategies visible within ancient economic systems. The primary aim of this research is to examine the social and economic systems associated with zooarchaeological data in order to gain a better understanding of the cultural context of Tell Madaba and to assess adaptive strategies over time. This was accomplished through the study of a large assemblage of animal bones recovered from Tell Madaba. The study examined samples recovered from seven occupational phases: Early Bronze Age I/II (EBA), Iron Age II (IRII), Late Hellenistic, Early Roman/Nabataean, Byzantine, Late Byzantine/Early Islamic, and Ottoman Period.

The Tell Madaba Archaeological Project was established in 1996 to expand an emerging regional database, and to facilitate analysis of the changing economic and socio-political organization of communities on a regional level, thereby enhancing the ability to chart the dynamic development of social complexity in the region over time (Harrison et al. 2007). The project constitutes part of a broader ongoing regional effort to investigate the range of adaptive strategies and social institutions developed by human communities in the semi-arid Central Highlands of Jordan. The Tell Madaba Project is based on three primary research objectives (Harrison 1996):

1) Document the changing subsistence strategies of specific communities over time
2) Identify the underlying social factors that may have influenced decision-making processes

3) Assess the impact that adaptive strategies have had on the fragile balance critical to maintaining ecological equilibrium and long-term viability in a marginal environment

To address questions concerning ancient economic systems and human adaptation, a multilevel strategy using both macro- and micro-level analysis was implemented. At the macrolevel, the primary cultural-historical goals of the project were to characterize the pastoral economy of the community at Tell Madaba across several chronological periods for which we have very little zooarchaeological knowledge, as well as to examine the relationship Tell Madaba enjoyed with neighboring political centers. The primary goal at the microlevel was to examine within-site variability across temporal and spatial contexts. The use of both macro- and micro-level analysis of the cultural and taphonomic circumstances surrounding the site provided a broader interpretation of the faunal samples recovered from Tell Madaba.

By documenting variability in faunal assemblages and identifying patterns in ancient economies, hypotheses regarding decision making processes and adaptive strategies employed by ancient communities can be tested. The faunal assemblage recovered at Tell Madaba was assessed using the abundance of taxa represented, carcass parts distributions, bone fragmentation, taphonomic assemblages, and harvest profiles. Variations observed in these categorical segments could indicate changes in cultural or economic decision making processes, adaptive strategies, innovations, and political and social changes, and thus provide insight into ancient animal production systems.

There is a close, almost symbiotic, societal relationship between animal production systems and subsistence, economics, religion, and symbolism. Hence, it is

expected that changes, on both macro and micro scales, in political systems, social systems, religious systems, ethnic groups, and economic systems would be reflected as adaptive patterns, that may be visible in faunal assemblages (Wapnish and Hesse 1988, Crabtree 1990, Zeder 1991, Hesse and Wapnish 2001; Horowitz and Milevski 1987 and 2001). Furthermore, these temporal and spatial changes can be used in formulating hypotheses about the people and culture present at the site and the region.

To elucidate the mechanisms behind economic change and adaptive strategies at Tell Madaba, this study compared a range of zooarchaeological models against the archaeological record. In doing so it illustrates that a large assemblage of faunal remains compared across space and time can contribute significantly to our knowledge of ancient adaptive strategies observed in social, cultural, and economic variations. This study represents one of the most comprehensive zooarchaeological studies in Jordan, to date, covering a broad span of time and cultures. The results are central to understanding the social, economic, historical, and adaptive dimensions of Tell Madaba.

This dissertation presents the results of a quantitative and qualitative analysis of the Tell Madaba faunal assemblage and provides supportive evidence leading to a better understanding of ancient social and economic adaptations in the semi-arid Highlands of Jordan. Chapter 2 provides a description of Tell Madaba based on location and physical attributes. Chapter 2 also provides a detailed discussion of the environmental, geographic, and physiographic setting of Tell Madaba. Chapter 3 provides a discussion of the archaeological investigations that have occurred at Tell Madaba, including the ongoing Tell Madaba Archaeological Project (TMAP). An abbreviated assessment for each

occupational phase represented at Tell Madaba is provided in Chapter 4. Chapter 5 outlines the history of zooarchaeology in the Near East and theoretical approaches used in this dissertation. A detailed description and discussion of the samples and methods used in this research are described in Chapter 6. Chapter 7 presents the detailed results of the faunal analysis. Chapter 8 provides an assessment of the Tell Madaba faunal assemblage within the context of Near Eastern ethnicity. Finally, Chapter 9 presents a summary of the findings and offers concluding remarks.

Common abbreviations used throughout this dissertation are as follows:

BCE- Before Common Era
CE- Common Era
EBA- Early Bronze Age
MBA- Middle Bronze Age
LBA- Late Bronze Age
IR- Iron Age
IRII- Iron Age II
LM- Large Mammal
MM- Medium Mammal
SM- Small Mammal
TNF- Total Number of Fragments
MNI- Minimum Number of Individuals
RF- Relative Frequency

CHAPTER 2
TELL MADABA SITE DESCRIPTION AND SETTING

Tell Madaba is a large mound site located 30 km southwest of Amman within the fertile plains of the central Jordan Plateau (**Figure 2.1**). The site has maintained a continuing urban character for up to 5,000 years. Currently, the modern town engulfs the ancient settlement, which is preserved in the form of a low lying tell and acropolis that still forms a visible rise in the town center. The ancient site, now located mostly beneath the modern town, is situated on a low natural rise created by the branches of the Wadi Madaba. This wadi, or dry river valley, flows eastward along the southern margins of the tell and eventually joins the larger north-south drainage of Wadi Zerqa Ma'in.

Tell Madaba contains steep slopes on the west, south, and southwest caused by erosion associated with the local drainage patterns. This has left only gradual slopes on the north and northeast sides of the site. Situated on the apex of the natural rise are the remnants of the ancient tell and acropolis. In addition, remnants of the ancient classical town consisting of churches and mosaic pavements are located to the north. Interestingly, Tell Madaba is not located near any perennial water sources. Therefore, numerous water catchment and storage systems were constructed over time to supply water to the populace, as evidenced by the abundance of cisterns and reservoirs still present at the site today (Harrison 1996:1).

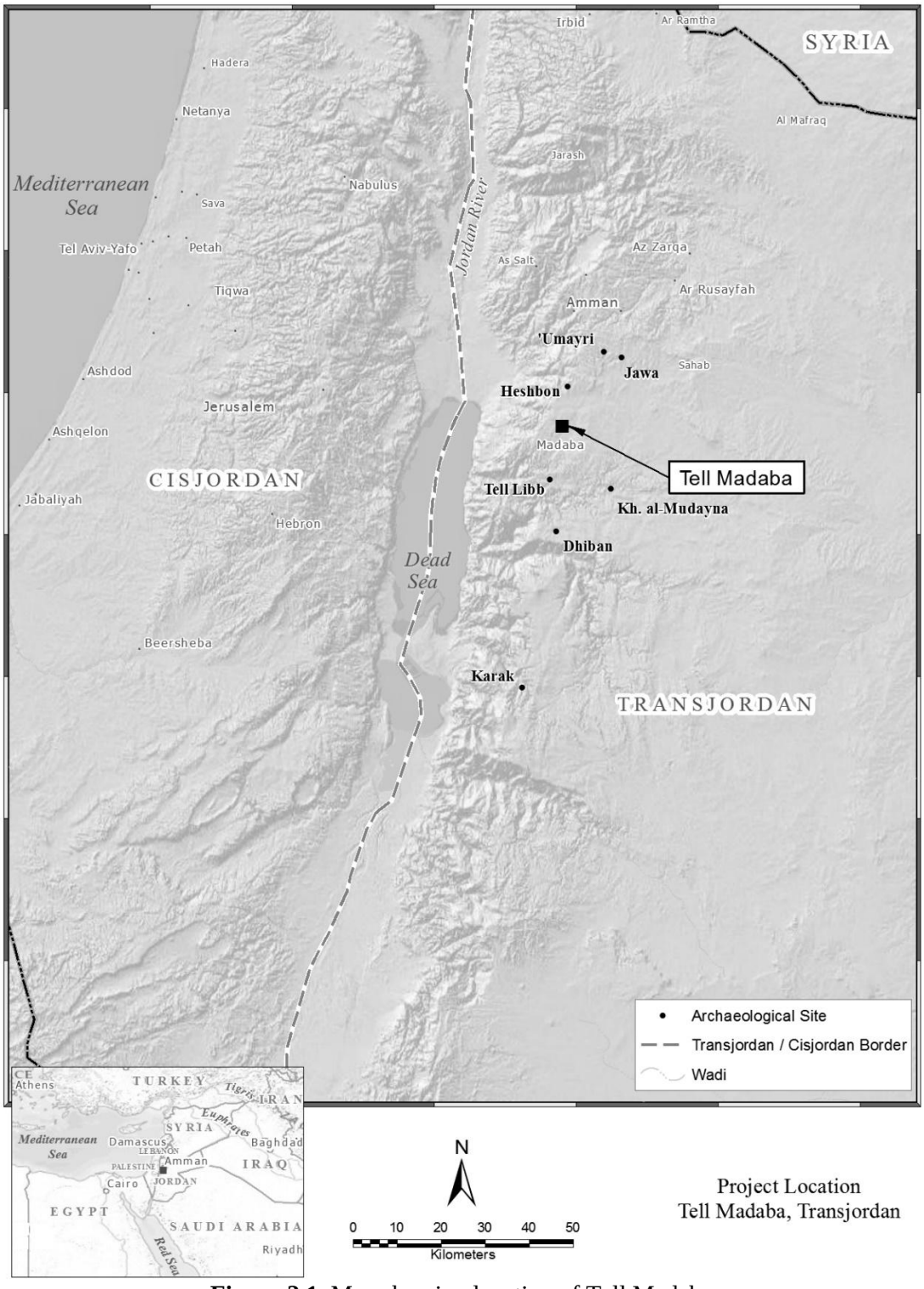

Figure 2.1. Map showing location of Tell Madaba

Environmental, Geographic, and Physiographic Setting

Tell Madaba is located in the fertile rolling plains region of the central Jordan Plateau. The Jordan Plateau extends north and south east of the Jordan Valley and consists of a complex system of rolling hills and plateaus divided by extensive dry river valleys called widayan (wadis) and dense rock outcrops. The topographic and climatic variability of the highland terrain significantly affects the environmental conditions in the region. The greatest amount of annual rainfall occurs along the western edge of the plateau. The rain drains westward along the plateau through the wadis cut into the surface, descending into the Jordan River. The plateau is bordered to the east by the dry steppes of the Arabian Desert, or Badia, and to the west by the somewhat more humid coastal plain. The Madaba Plain is located between the Dead Sea escarpment to the west, the rolling hills of Amman in the north, the dry Arabian Desert to the east, and the large cavernous Wadi Mujib to the south. Jordan has four main physiographic regions: the Jordan Rift Valley, Jordan Highland, Jordan Plateau, and South Jordan Desert (**Figure 2.2**).

The Jordan Rift Valley is located along the western edge of the country and extends from Lake Tiberias in the north to the Gulf of Aqaba in the south. It lies between 200 and 400 m below sea level, with a length of 104 km and a width of 4 to16 km. Mountains surround the valley to the east and west. Annual rainfall decreases from approximately 300 mm in the north to 102 mm in the South.

The Jordan Highlands extend from the Yarmouk River through the Ajloun Mountains. Watercourses in the highlands typically drain to the west emptying into the

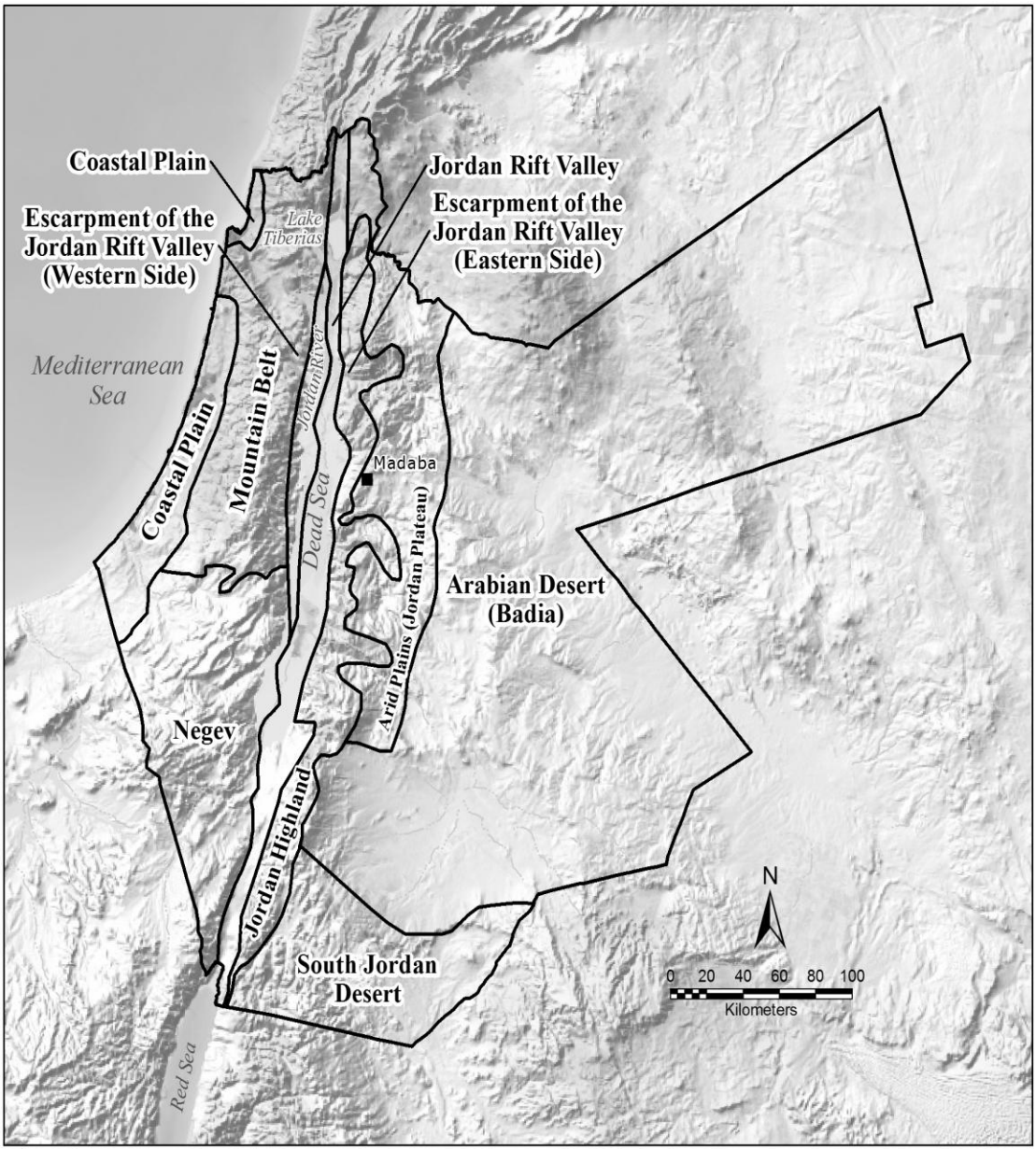

Figure 2.2. Physiographic regions of Jordan

Jordan River, Dead Sea, and Wadi Araba. The average altitude ranges from 600 m in the north to 1,000 m in the central region to 1,500 m in the south. The highlands are comprised of two basic zones: a semi-arid zone (350-500 mm annual rainfall) and a small sub-humid zone (over 500-mm annual rainfall).

The Arid Plains are located between the Badia (Eastern Desert) and the Jordan Highland. Rainfall ranges between 200 mm in the east to 350 mm in the west. Over 50% of the arable land in Jordan is located across this region. The Badia (Eastern Desert) covers about 90% of Jordan and is characterized by a very sparse vegetation cover and an annual rainfall of less than 200 mm.

The Jordan Plateau extends north and south along the Jordan Valley and the Dead Sea forming an extensive escarpment to the east of the rift. Although prevailing winds carry moisture eastward, dropping the greatest amount of precipitation along the western edges of the plateau, runoff moves in the opposite direction, draining westward along wadis, that cut deep into the plateau leading into the rift. This has created an extremely fractured landscape of rolling hills and plains broken by deep wadis and rocky outcrops (Fisher 1978; Beaumont et al. 1988; Harrison 1997).

Rainfall in the more arid regions can deviate from averages by more than 50%. Between 1952 and 1962 the annual precipitation at Jiza averaged 205.6 mm, but varied between a high of 360.0 mm (1953-1954) and a low of 94.5 mm (1952-1953), which represents a 54 to 75% deviation from the average. Madaba averaged 310.6 mm per year, but had a high of 517.9 mm (1956-1957), and a low of 141.0 mm (1959-1960), or a 55 to 67% variation, while Na'ur averaged 459.6 mm, with a high of 638.9 mm (1955-1956) and a low of 253.6 mm (1959-1960), a 39 to 45% deviation. Variability in annual precipitation across the Madaba Plains, when one part of the region receives above average rainfall while other areas experience deficits, significantly affects environmental conditions and settlement patterns (Harrison 1997).

The rainy season is often brief, but can be very intense. Rain may be recorded between October and May, but records show that approximately 75% of the annual rainfall occurs between December and February (Harrison 1997: 5). Local vegetation can be affected by variations in rainfall during particular months and from one year to the next. These conditions create a considerable degree of environmental uncertainty and risk to local human communities (Harrison 1997). Based on recent research (Cordova 2007; Rambeau 2010; Sapir-Hen, et al. 2014) only minor shifts in ecological conditions have been detected for the 5000 year occupation at Tell Madaba. However, Rambeau (2010:5227) states that significant climatic events are documented between 25,000 and 5000 BP. Rambeau (2010:5229) also claims that an increase in precipitation at the end of the EBA may have led to a decline in settlements. Sapir He et. al. (2014:703-704) argue that changes seen in animal production systems between the LBA and the IR are related to historical and regional factors and not environmental conditions.

CHAPTER 3
ARCHAEOLOGICAL AND HISTORICAL EXPLORATION AT TELL MADABA

Tell Madaba has a long and varied history of archaeological and historical exploration beginning in the early 19th century and continuing today with the Tell Madaba Archaeological Project. These investigations include surveys, mapping, historical documentation, and full-scale excavations and salvage archaeology projects. The first recorded expeditions to the site consisted of teams, mostly from Europe, searching for and collecting antiquities for elite individuals and governments. Several of these expeditions have resulted in detailed descriptions of Jordan and Tell Madaba. Below is a brief description of the archaeological and historical explorations that have taken place in the region.

In 1806, Ulrich Seetzen from Germany led a team to Tell Madaba, making this one of the earliest recorded visits to the site. Between 1805 and 1807, his expedition focused on acquiring antiquities throughout the region. His team arrived at Tell Madaba on March 22, 1806 (Harrison 1996: 6; Seetzen 1813; 1854-55:407-408). Seetzen described a large structure containing two columns and a lintel situated west of the tell apex. His work produced the first historic description of the Birkeh, the Roman reservoir. This expedition also recorded several caves in the area, but did not describe any occupants in the area, suggesting that the site was not occupied at that time (Harrison 1996:6).

Next, in 1812 a Swiss team led by Johann Burkhardt visited Madaba and provided details of some of the previously described features. The description included the large

building with columns to the west of the tell, several water collection and storage facilities in the area surrounding Madaba, and the Birkeh (Burchardt 1822:36-67). Burkhardt (1822) concluded that the Bedouin were using these features (Harrison 1996, 1997).

In 1817, Charles Irby and James Mangles from the English Navy were the next explorers to visit the region around the Dead Sea. During this expedition, they stopped at Madaba, focusing only on the large pool (Irby and Mangels 1823:471). The area of Transjordan was hardly visited by explorers over the next 50 years, leaving very little historical documentation. Only two visits are known to have occurred during this time, one by L. F. de Saulcy in 1851 (Saulcy 1853) and the other by Duc de Luynes in 1864 (Luynes 1874; Harrison 1996:6).

In 1868, the Moabite Stone was recovered at Dhiban and drew international attention to the region. This particular find was historically significant because of its reference to the Moabite Kingdom, leading to an abundance of historical and archaeological activity in the region. H.B. Tristram (1873) directed one of the more successful projects while under the direction of the Palestinian Exploration Fund. He provided detailed descriptions of the ruins, topography, environment, and human settlements and activity across the Madaba Plains (Harrison 1996:7). During his expedition, Tristram spent four days in Madaba describing the site (Tristram 1873:322-328). He realized the historical significance of the site and had his team systematically survey it, documenting the visible remains of streets, walls of old buildings, small sections of a city wall, rubble of a collapsed gate at the east end, and numerous

inscriptions.

Tristram also provided details of the twin columns and cave system located just west of the tell and recorded a large colonnade square within the eastern gate just north of the street, and a partially filled reservoir outside the eastern gate with a paved street leading to it from the northwest (Tristram 1873:328; Harrison 1996:7). Tristram states that much of the land surrounding Madaba was cultivated by the Beni Sakhr Bedouin tribe, or by their slaves. When his team visited Madaba, the site was unsettled, except for a few temporary structures. However, he duly noted the significance placed on the site by the local Bedouin.

Lt. Edgar Steever and John Paine led a team into the Transjordan region in 1872 under the direction of the American Palestine Exploration Society (APES). This expedition was an effort to survey and map the region of Transjordan in response to the British expedition to survey western Palestine. Unfortunately, the expedition ended in failure. A second team, led by Selah Merril in 1875, also ended poorly but did manage to provide descriptions of their travels throughout the region. These descriptions provide a brief mention of Madaba and the building with the two standing colonnades, identifying them as a church and the Birkeh (Merril 1881:252).

In 1881, the survey of western Palestine was completed by the British, who then sent another team led by Claude R. Conder to complete the survey of Transjordan (Conder 1883 and 1889). This expedition was initiated on the Balqa', where the Americans had left off, and spent a significant amount of time in this region (Harrison 1996:7). Due to the political climate, the Turkish government became suspicious of the

project and put an end to it after just several weeks. In that time, the team managed to survey approximately 500 square miles, including much of the Madaba Plains region beginning on September 27, 1881 (Harrison 1996:7; Conder 1883 and 1889). This work resulted in detailed measurements of the Birkeh, colonnade street, and a large structure that they labeled as a church. They also describe the western building with the two standing columns as the "gallows of Abu Rok," from the regional legend that sheikh Abu Rok had held court under the columns and would execute the convicted by hanging them from the lintel above the columns. Conder's team described an eastern gate but was unable to locate the other 19 gates described by the local inhabitants (Conder 1889:181).

Turkish political restrictions relaxed in 1895, allowing Fredrick Bliss to lead a team through the regions of biblical Moab and Gilead (Bliss 1895:205-212). During this project they stopped at Madaba for several days and documented that some of the features recorded earlier had been removed and new features had been constructed (Bliss 1895:205-212). Bliss and his team spent time looking for evidence of fortifications. This effort located a section of the northern gate, and a possible course of the wall (Harrison 1996:10).

In 1884, a monk from Madaba, in a letter to the Greek Orthodox Patriarch of Jerusalem, Nicodemus, described a mosaic covered with Greek names of many Levantine cities. Initially, the significance of the mosaic was not recognized; however, it eventually became one of the most important archaeological and historical finds in Madaba. The letter was not addressed until 1890, when Nicodemus's successor, Gerasimus, decided to investigate. He initially sent an architect to inspect the mosaic to determine its

importance. If considered important, the mosaic would have been incorporated into the floor of a proposed chapel. Unfortunately, these instructions were not carried out, and the new chapel was built north of the mosaic, which resulted in the destruction of part of the mosaic and foundation of the Byzantine church that once stood there. The architect reported to Gevasimus that the mosaic was unimportant despite the statement of four monks who contended that the mosaic was almost complete (Clermont-Ganneau 1897; Piccirillo 1989:76-78; Harrison 1996:10).

In 1895, when the Greek Orthodox chapel was to be replaced with a larger one, the mosaic map was finally recognized as a very important historical feature. The new structure is the present-day Church of Saint George. At the time of the construction, Cleophas Kikylides visited Madaba and recognized the significance of the map. He proceeded to draw a sketch and take notes about the map. Following his return to Jerusalem, a surveyor was sent to Madaba to make detailed drawings of the site, including the mosaic pavement containing the map. In 1897, M. J. Lagrange and L.Hugues Vincent of the Ecole Biblique in Jerusalem conducted their own study of the map. Descriptions of the map were published in two separate reports. First, Kikylides (1897) published a report of his 1896 work. Next, Lagrange (1897) published the results of the study that he and Vincent completed. Interestingly, even though it is safe to assume that the mosaic's existence was known by the local residents, there was no mention of the map or the pavement by earlier explorers such as Schumacher, Sejourne, or Bliss.

Following the identification and dating of the Mosaic Map in 1897, Madaba became internationally known, which started an array of studies; some of which

attempted to analyze and interpret the details of the map. These projects were the catalyst for the discovery of several other mosaic pavements (Sejourne 1897; Manfredi 1899:157), such as the Bacchic scene on the floor of the house of Mis'ad al-Twal (Manfredi 1899:167).

The Roman Catholic priest, Fr. Giuseppe Manfredi, made numerous archaeological discoveries, including the Twal house mosaic, the Church of the Prophet Elias, the Crypt of Saint Elianus, and other churches dating to the Byzantine era. Each of these finds was reported by Manfredi in an article published in 1899. He is also credited with uncovering the dedicatory inscription of the Church of the Apostles in 1902 (Vincent 1902). Alois Musil provided a detailed plan drawing of the town for Manfredi (Musil 1907:115).

During the early 20th century archaeological projects in Jordan were interrupted when political unrest began to destabilize the region. However, there were a few other discoveries prior to the 1916 Arab Revolt. For example, Hippolytus Hall was found under and to the west of the Church of the Virgin Mary and the report of its discovery was published by Metaxakis (1905:459). Also, in 1911, M.R. Savignac published details of a dedicatory inscription located north of the apse of a church. Transjordan was engulfed in war during the 1916 Arab Revolt, and over the next two decades there were neither expeditions nor discoveries at Madaba (Harrison 1996:12).

During the 1930s, archaeological exploration throughout Transjordan resulted in significant discoveries. Also, the work of Nelson Glueck, which began in 1932, initiated a new era of archaeological interpretation through ceramic analysis. His detailed analyses

allowed for the tracing of the occupational history of each site surveyed, thus producing a cultural history of settlement in the Transjordan region. This interpretive approach was distinct from previous methods that were more speculative. The information generated from Glueck's studies provided a more sophisticated regional ceramic sequence than his predecessors efforts had generated. Furthermore, Glueck (1933:34-36) provided detailed descriptions of Nabataean, Roman, and Islamic sherds collected at Madaba.

In July 1933, the Stadium Biblicum Franciscanun began archaeological investigations at Siyagha-Mount Nebo under the direction of Sylvester Saller. Excavations by the Franciscan order of the Catholic Church have been ongoing at Mt. Nebo ever since. Details of additional mosaics discovered at Tell Madaba, including one in the west chapel of the Twal family, which had been previously reported by F. M. Abel (1934), and the other in the house of the 'Alamat family, were published by Saller and Bagatti (1949:236-240).

Following the end of World War II, numerous construction projects began throughout Jordan, with many inadvertently uncovering archaeological sites and features. Madaba, in particular, yielded several new finds, including a large slit cave tomb containing an extensive cache of Late Bronze Age and early Iron Age (ca. 1250-1150 BCE) pottery (Harding 1948:119; Harding and Isserlin 1953). This find provided the earliest estimated dates for human activity at Madaba.

Several salvage and restoration projects occurred at Tell Madaba after the Jordanian Department of Antiquities placed an office at the site. The Department of Antiquities opened the Madaba Archaeological Museum in 1962, resulting in more

regulated construction at the tell. For example, in 1960, two rooms with mosaic pavements were uncovered in the southwest section of the modern town during road construction (Ma'ayeh 1960:116; Piccirillo 1989:136-139; 1993). Several mosaics were found in 1966 in the Qsar house, located just west of the Tell (Rafik and Dajani 1966:584; Piccirillo 1986:326-327). Also in 1966, Ute Lux of the German Evangelical Institute excavated the Church of the Martyrs (Church of al-Khadir) (Lux 1968;Piccirillo 1993:106-107), and in 1967 his team excavated the Church of the Apostles (Lux 1968; Noth 1968; Piccirillo 1993; Harrison 1996:13). That same year an Iron Age tomb was reported along the southeastern edge of the refugee camp south of the tell (Piccirillo 1975; Thompson 1984, 1986; Harrison 1996:13).

The Department of Antiquities conducted several excavations in the late 1960s and early 1970s. In 1968, excavations at the Cathedral Church complex uncovered the west courtyard and the adjoining Chapel of the Martyr Theodore (Qandil 1969; Saller 1969). In 1972, the Department of Antiquities began work on other churches. Bastiaan van Elderen, then Director of the American Center of Oriental Research (ACOR) in Amman, excavated the Salayta Church (van Elderen 1972; Ibrahim 1974:14; Piccirillo 1993). Through 1973, van Elderen continued archaeological work at the Church of the Prophet Elias, portions of the Church of the Virgin, and the apse and presbytery of the Cathedral Church (van Elderen 1973; Ibrahim 1974:14).

Work resumed on the Cathedral Church in 1979 under the direction of Michele Piccirillo and continued into 1980 (Piccirillo 1980). Also, in 1979 Piccirillo began excavations along the Roman cardo and around the Church of the Virgin Mary (Piccirillo

1980, 1982). Those projects continued until 1985, and succeeded in locating the eastern half of the Hippolytus Hall under the vestibule of the Church of the Virgin (Piccirillo 1982:386-396). In 1980, earth removal along the western slope of the acropolis exposed a series of barrel-vaulted shops paved with mosaic floors, adding to our knowledge of the classical town (Piccirillo 1989:140-141, 1993:80).

In 1985, Piccirillo turned his attention to the section of the Roman cardo north of the Church of the Martyrs (al-Khadir). There, excavations soon brought to light another partial structure paved with mosaics; a large residential complex that had apparently been destroyed by fire. Piccirillo named this structure the Burnt Palace (Piccirillo 1986, 1993:78).

That same year, a salvage excavation uncovered yet another mosaic pavement near the cardo (Suleiman 1987:543). The 1980s also saw the discovery of a number of historically significant inscriptions. In 1986, Piccirillo identified the Latin inscription of the centurion Lucius Vellina Firmus (Gatier 1987), and in 1989, during construction near the Birkeh, an imperial inscription commemorating the completion of an official building near the city gate in 219/220 CE was found (Piccirillo 1989:105).

Finally, in 1991, the Ministry of Tourism and Antiquities and the American Center of Oriental Research (ACOR), with funding provided by the United States Agency for International Development (USAID), initiated a major archaeological project. The overall purpose of the project was to create an archaeological park in areas immediately adjacent to the exposed Roman street that runs east-west for approximately 50 m before making a southwestward turn towards the acropolis. As part of this project,

excavations in the area of the Roman street were reopened in preparation for the construction of a shelter over the Church of the Virgin Mary and Hippolytus Hall. Under the direction of Cherie Lenzen, a section of the Roman cardo near the Burnt Palace was excavated. In 1993, Ghazi Bisheh uncovered the western part of the Burnt Palace. At the same time, Piccirillo began work in the Batjaly area of the Madaba Archaeological Park. In 1994, Bisheh uncovered a mosaic in the narthex of the Church of al-Khadir, revealing that it had originally been called the Church of the Martyrs.

One of the most important archaeological studies conducted at Madaba was an intensive survey by Harrison (1996a). In 1996, in an effort to gain an understanding of the shifts in occupation settlements at Tell Madaba, Harrison conducted a systematic collection of ceramic sherds across the site. Unfortunately, the presence of the modern town prohibited collection of a large portion of the site. However, collection of ceramic sherds from accessible grid units yielded a 4,500-year occupation sequence. The survey produced 8,242 sherds that represented EBA, IRII, Persian/Hellenistic, Nabataean, early Roman, late Roman, Byzantine, Umayyad, Abbasid, Fatimid, Ayyubid/Mamluk, Ottoman, and other modern periods.

Harrison's survey was part of a larger project funded by USAID and ACOR to create a database for future research and development efforts in Madaba. The survey provided a wealth of information about the settlement history of Tell Madaba. The distribution of sherds collected in 1993 indicate that the town of Madaba was restricted mostly to the tell and acropolis during the EBA and Iron Age. The city proper expanded to the north during the Nabataean and early Roman period, and reached its greatest extent

during the late Roman and Byzantine periods. Following the Byzantine period, the town began to decrease in size, and during the early Islamic period may have been abandoned. Madaba remained much the same in the following century, However, during the early 1900s Christians from Karak began to settle at Madaba. The limited amount of Ayyubid/Mamluk and Ottoman sherds recovered from the site suggests that at least some occupation occurred at Madaba during those periods.

Tell Madaba Archaeological Project

In 1996, the Tell Madaba Archaeological Project (TMAP) was initiated by Timothy P. Harrison and continues today. The faunal material analyzed in this study originated from three specific excavation areas: Fields A, B, and C (**Figure 3.1**). Excavation in each of the three areas has revealed architectural remnants. Below is a description of each area and their architectural associations.

Field A

In 1996, excavations took place in Field A in an effort to produce a stratigraphic profile of the tell. Those efforts focused on the southeastern slope where previous farming activities had cleared a portion of the lower mound, revealing a vertical face containing numerous cultural deposits. The excavations consisted of three 10 X 10-m excavation units; Squares 3N22J, 3P21F, and 3P21G (**Figure 3.2**). Over the course of the field season, an 8-m vertical section was revealed. This section extended from the ground surface to bedrock exposed at the base. Early Bronze Age deposits were encountered within the lowest levels, just above bedrock. In addition to the EBA deposits, IRII

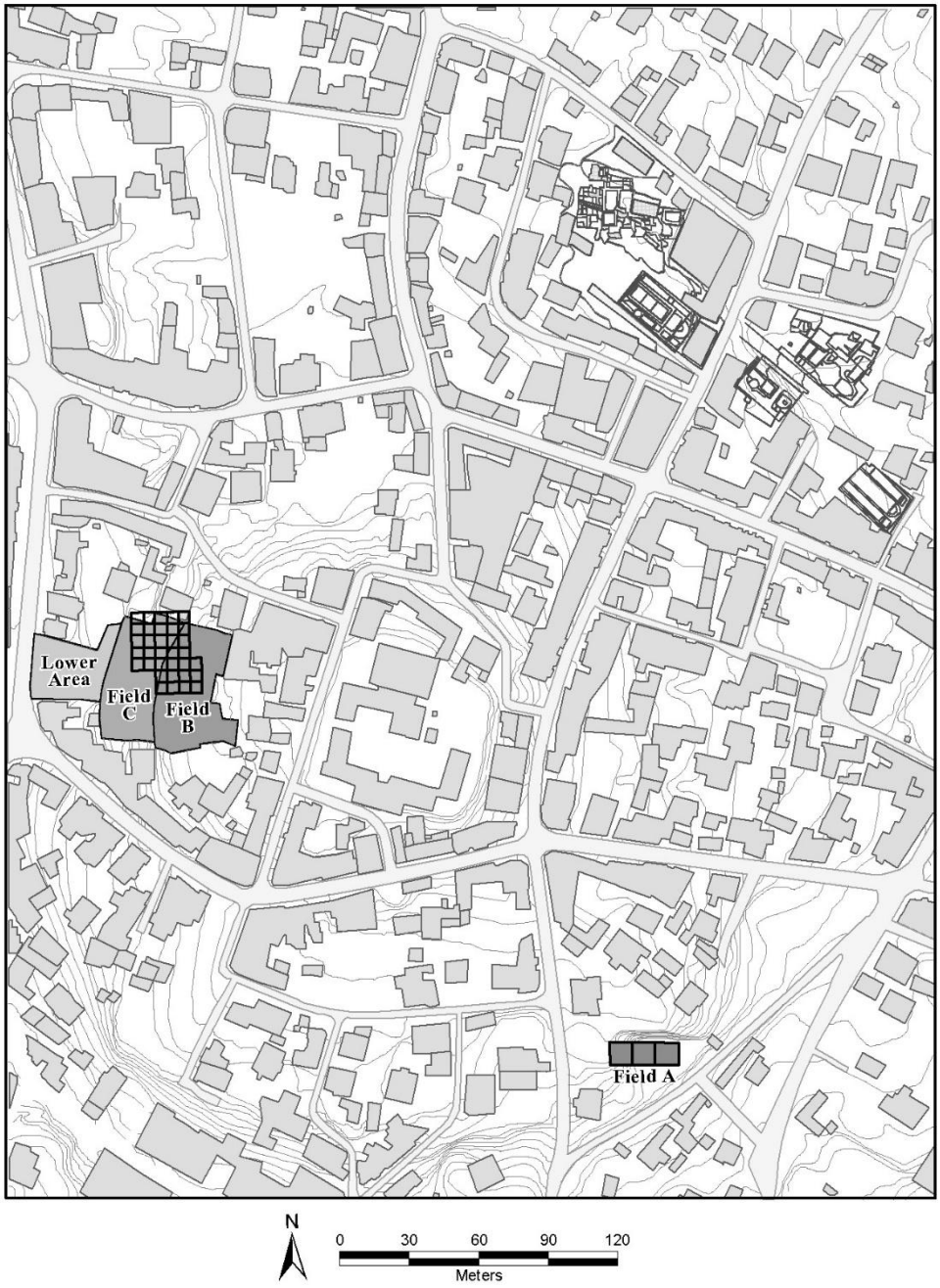

Figure 3.1. Plan view showing excavation fields at Tell Madaba

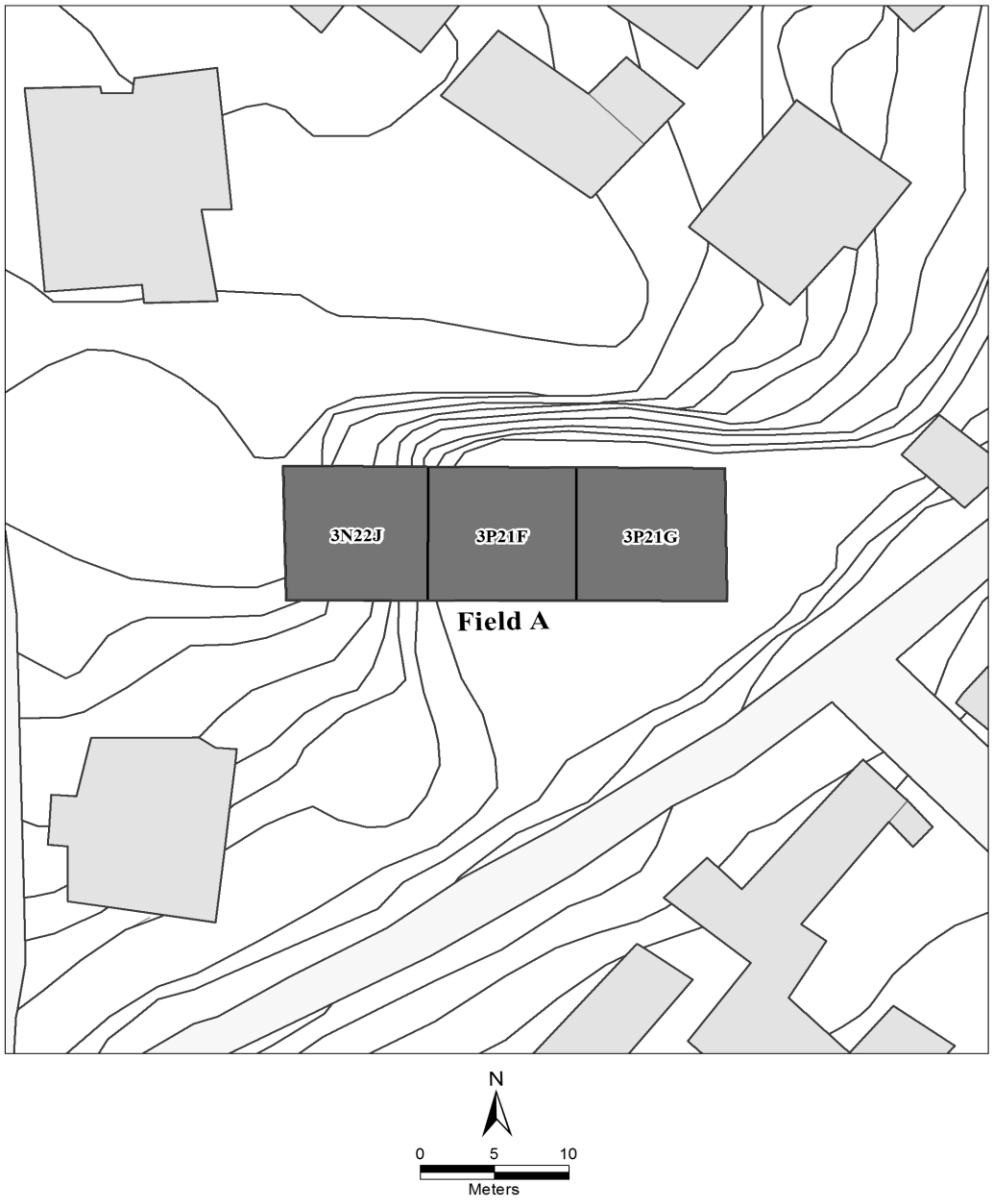

Figure 3.2. Plan view of excavated areas in Field A

deposits were present in the upper levels. Field A excavations revealed two architectural phases: a single large wall that ran in a northeasterly direction through 3P21G, and a rectangular structure that included part of an earlier wall.

Field B

Excavations in Field B began in 1998 and have yielded ceramics dating to the Late Ottoman, Late Byzantine/Early Islamic, Early Roman/Nabataean, Late Hellenistic, Iron IIC, and Iron IIB, Iron I/Iron IIA, and Late Bronze/ Iron IA periods. Five 5 X 5 m excavation units were opened in 1998 (5M21U3, 5M21U4, 5M11A1, 5M11A2 and 5M11A3) and five additional squares were opened in 1999 (5M21U2, 5M21V3, 5M11B1, 5M11B3 and 5M11A4) (**Figure 3.3**) . The 1999 excavations succeeded in uncovering substantial deposits and architectural remains from the Iron II, Late Hellenistic, Early Roman/Nabataean, and Late Ottoman periods. In 2000, excavations in Field B were limited to Squares 5M21U4, 5M21V3, 5M11A2, and 5M11B1. In addition, a new square (5M21U1) was opened in an effort to further delineate the northern extent of the pre-classical fortification wall. Excavations in 2002 continued in squares 5M21V3 and 5M21U4, where a room containing significant Late Hellenistic material was found.

Field C

In 1998, excavations were initiated in Field C, and by 2002 had uncovered the remains of a large Late Byzantine/Early Islamic structure. Much of Field C had been significantly disturbed during the 1980s by heavy machinery during construction activities. Therefore, it was deemed prudent to initiate excavations in the area in an

attempt to investigate the archaeological remains and to preserve several structures. The large IRII fortification wall that had been uncovered served as the delineation between Fields B and C, based on the assumption that Field C would contain a separate occupational phase not related to Field B.

Figure 3.3. Plan view of areas excavated in Fields B and C

Tell Madaba Ceramic Assemblage (1996-2002)

The EBA ceramic assemblage recovered from Tell Madaba consists of bowls, cups, platters, deep bowls, a pedestal bowl, jugs, necked jars, flared rim jars, and rounded rim holemouth jars. Most of the pottery was handmade, and a small number of vessels exhibited evidence of surface treatment. Painted reddish-brown decoration was identified on a few bowls, and hand burnishing was seen on the platters. A single necked jar was burnished, and a second one contained a reddish brown painted decoration applied to a white slip. Stylistically, the ceramic assemblage consisted of types assigned to the EBA I or EBA II from other sites in the region.

The IRII pottery recovered from Tell Madaba is mostly undecorated, demonstrating no evidence of wheel burnishing (Harrison et al. 2000). Some of the ceramic forms were particularly common throughout the IRII, like the single ridged cooking vessel. Most forms are associated with the later part of the IRII, such as the S-rim kraters that date to the 8th and 7th centuries BCE Furthermore, the change in rim profiles of folded rim bowls to a more round form occurred during the later IRII (Routledge 2004:181). White slip was common on the ceramic assemblage, with an abundance of fine ware bowls and jugs decorated with alternating reddish brown and black horizontal painted bands. There was no evidence of wheel burnished pottery or forms associated with the IR II/IIC in the region (i.e. late 7th through 6th centuries BCE).

A number of late forms, mostly rectangular rimmed cooking pot dating to the Late IR IIB/Iron IIC, were recovered in an isolated area in Field B. Unfortunately, most of this material came from later fill that also contained a significant amount of Hellenistic

pottery. Although the fill came from elsewhere on the site, it does indicate the existence of an IR IIC occupational phase, but does not provide a terminal phase for the Iron II sequence in Field B.

The Late Hellenistic assemblage consists of imports such as lamps and amphora and demonstrates different production process in form and material. The material is from various clay sources that are distinct from the succeeding occupational phases. The assemblage clearly was the product of different and disparate ceramic industries and cultural traditions.

The Early Roman/Nabataean ceramic assemblage consisted of both imported wares, including a Nabataean Painted Fine Wares from the Petra region, as well as terra sigillata and other Early Roman wares. The shift in ceramic production suggests that Madaba was engulfed in the Nabataean culture by the end of the 1st century BCE. NAB-I sherds produced between 50 BCE and 40 CE, and examples of the later NAB-II produced between ca. 9 BCE and 106 CE were recovered in sequence. Assessment of the ceramic assemblage indicates there was a cultural connection between Tell Madaba and the Nabataean world from the mid-1st century BCE to the mid-1st century CE.

The Field C ceramic assemblage consisted predominantly of 6th through 7th and 8th through 9th century CE material. Mixed within this area was an abundance of glazed wares. Broken pots were recovered across the dirt surface of a room in Square 5L22Y2 and included bowls, cooking pots, storage vessels, and a number of bronze and iron implements. The fill within this room produced fragments of painted plaster that included portions of a Late Greek inscription and parts of two crosses. Numerous coins and a

ceramic stamp seal incised with a cross were recovered from other rooms in Field C. Overall, the ceramic assemblage in Field A suggests a Late Byzantine-Early Islamic transition occupation that coincided with two distinct construction phases. First, there was a 6th century, or Late Byzantine phase that included mosaic pavements. Then the building underwent a renovation during the 7th or early 8th century (during the Umayyad period). The complex was abandoned during the late 8th century CE.

The ceramic assemblage associated with the Ottoman occupation consisted of handmade wares and several Ottoman pipes. The historically documented late 19th century resettlement of Madaba by migrating families from Kerak probably caused the Late Ottoman construction activity in Field C. Ottoman pottery recovered from Field C consisted of handmade wares, included both chaff and lithic tempered pottery (bowls and cooking pots), as well as numerous tobacco pipes. The Late Ottoman pottery typically was decorated with painted geometric designs, or occasionally covered with a reddish brown slip and hand burnished.

CHAPTER 4
HISTORICAL SETTING OF TELL MADABA

The modern Near East has a long history of urbanism, and the consequences of this urban continuity and constantly changing political landscape presents significant challenges to archaeological research. The city of Madaba has had approximately 5,000 years of human occupation spanning several distinct chronological periods (Harrison 1996a; Harrison et al. 2007). Madaba's historical and archaeological prominence necessitates a thorough assessment of its role in the long and eventful history of the region. Basic to archaeological histories is the ability to conduct period-by-period characterization of settlement structure and the assessment of the process of cultural and community development. This is especially true for the historic periods in the Near East. Analysis of animal bones from these particular contexts can elucidate transformations in ancient societies because animals played a major role in human subsistence and ideologies.

The research presented here documents and compares variations within the ancient animal-based economy throughout several occupational phases. Since animals were a significant part of ancient economic systems, they are suitable for this type of analysis. In this project, I analyzed a large faunal assemblage from Tell Madaba in an attempt to explain human adaptive strategies established within the local and broader economic, social, geographical and political spheres of the ancient Near East, over time. The faunal assemblage is associated with communities that inhabited Tell Madaba during seven occupational phases; EBA, IRII, Late Hellenistic Period, Early Roman/Nabataean,

the Byzantine Period, Late Byzantinte, and the Islamic Periods (**Table 4.1**). Societies and economies are affected significantly by many different human activities.

Table 4-1. Chronological Time Periods in the Near East			
Period	**Jordan**	**Egyptian**	**Mesopotamia**
Neolithic	9000-4500 BCE		Hussuna, Samarra, Halaf, Ubaid
Chalcolithic	4500-3500 BCE	Early Pre-Dynastic	Ubaid
EBA I	3500-3100 BCE	Late Pre-Dynastic	Proto-Literature A,B
EBA II	3100-2650 BCE	1,2	Proto-Literature C,D; Early Dynastic I
EBA III	2650-2300 BCE	3-5	Early Dynastic II, III
EBA IV	2300-2000 BCE	6-11	1st Dynasty of Akkad; Ur III
MBA I	2000-1775 BCE	12	Old Babylonian, Old Assyrian
MBA II	1775-1650 BCE	13, 14	Old Babylonian, Old Assyrian
MBA III	1650-1550 BCE	15-17	Kassite and Sealand Dynasties
LBA I	1500-1400 BCE	18	Kassite and Sealand Dynasties
LBA II	1400-1200 BCE	19	Kassite and Sealand Dynasties
IRI	1200-1000 BCE	20,21	Neo-Assyrian, Neo Babylonian
IRII	1000-586 B.C.E	21-25	Neo-Assyrian, Neo Babylonian
IRIII	586-539 BCE	26	Neo-Babylonian
Persian	539-322 BCE		Persian (Achaemenid) Empire
Hellenistic	322-63 BCE		
Roman	63 BCE-CE 325		
Byzantine	CE 325-CE 636		
Islamic Periods	661-1918 CE		

Population increases and decreases can alter the animal production systems within the broader economic scheme. Geo-political control, or absence of it, can significantly or subtly change social and economic institutions. Shifts from urban centers to rural or village communities, or vice-versa, can be reflected in cultural material recovered from archaeological sites. Archaeologically known patterns of change within society, both locally and regionally, can contribute to interpretive synergy for studying human adaptive strategies. This is especially true for faunal assemblages. The research presented in this dissertation interprets these shifts or changes through history, as reflected in patterns of production-distribution-consumption within animal bone samples that were affected significantly by the turbulent history of the locality and region.

The faunal analysis identifies animal production systems and their responses to adaptive strategies within and between the various occupational phases and across the region. The primary focus of this research is to investigate changes through time in the animal production, distribution, and consumption systems in place at Tell Madaba as each successive political and cultural group replaced the previous one over a 5,000-year period.

The following section provides essential, albeit brief, historical background information pertaining to the cultural, socioeconomic and sociopolitical history of the southern Levant. Due to the nature of archaeological research in this region, it is important to consider both archaeological and historical data to gain an understanding of the changing political and cultural landscape in the ancient Near East. Significant historical events and socio-cultural changes can alter the composition of animal production and distribution systems. In order to fully understand the animal production systems that supported Tell Madaba, it is important to have a broad understanding of the historical and cultural events surrounding the chronological time periods represented. Furthermore, the historic period sites throughout the Near East were often engulfed in larger geo-political systems on a regional scale, making it prudent for archaeologists to understand the events that affected the entire region. As the shifting sands of an arid desert alter the natural landscape, so too did the shifting political control and alliances throughout the later historic periods of the Near East shift the cultural landscape that shaped the region.

Historical Context of the Near East

The Near East presents a very interesting and complex situation for archaeologists. Archaeologists working on Near Eastern sites must be aware of and fully understand the dynamic historical events of those periods that dramatically affected the entire Southern Levant. This is especially true for the later historic period sites, i.e., Bronze Age throughout the Ottoman Period. This is also the case for Tell Madaba, which has been engulfed in the geographical and geopolitical history of the region for over 5,000 years.

A basic understanding of the historical events that shaped the Southern Levant during the occupational phases represented at Tell Madaba is a necessity in order to interpret the archaeological remains. As mentioned above, deposits dating to the EBA, IRII, Late Hellenistic, Early Roman/Nabataean, Byzantine, Late Byzantine and Early Islamic periods are represented at Tell Madaba. This section provides a brief overview of the historical aspects of the regions that affected the occupations at the site. In some cases, historical documents and text are used to illustrate Tell Madaba's role during the specific periods.

Bronze Age

Representing significant technological advances, the Bronze Age separates the Stone Age from the Iron Age and is characterized by the widespread use of copper and bronze to make tools, weapons, and other implements, as well as art throughout the Near East. Some scholars have suggested a transition period between the Chalcolithic age and the Bronze Age at ca. 3500 B.C.E (Gilead 1988; Oren and Yekutieli 1992; Gohpna

1995). The start of the EB I is relatively dated to the 35th or 34th centuries BCE (Gophna 1995; Gilead 1988; Kempinski 1978; Kempinski and Gilead 1991; Oren and Yekutieli 1992). Many historical events in the Near East have affected population movements and increases, in addition to playing a major role in human adaption and economic shifts during the Bronze Age.

Several phases of the Bronze Age are some of the most studied periods in Near Eastern archaeology and history, and a cursory review of the literature illustrates the abundance of published work (see Alt 1968; Richard 1987, 2003; Levy 1995; Harrison 1993, 1997, 2000a, 2000b, 2001, 2003, 2007, 2008, 2011; McDonald et al. 2001; Clark and Matthews 2003; Dever 1995, 2003; Dornemann 1983; Richard 2003; Beit-Arieh 2003: Long 2003; Ilan 2003; Nakhai 2003; Lemche 1985; Leonard 2003; Gophna 1995; Ilan 1995; Richard 1987; Ben Tor 1992; Bunimovitz 1995; Savage et al. 2007; Stager 1993, 1995; Philip 2001; Prag 1954, 1971, 1974;Falconer 2001; Palumbo 2001; Strange 2001).

The Bronze Age is divided into Early, Middle, and Late. Very little has been published on the Early Bronze Age (EBA) from a complete Jordanian perspective. Most of the work is from the Palestine side of the Jordan River and considers Transjordan as an eastern extension of Palestine (van der Brink 1992; Harrison 1993; Levy 1995; Philip 2001). The published literature tends to follow the socio-cultural developments throughout Canaan (Richard 1987; Ben-tor 1992; Stager 1993; Gophna 1995). Harrision (1997) has published a detailed description of settlement patterns along the Madaba Plain

during the EBA, drawing primarily from survey data since EBA deposits and excavations are limited.

Many scholars have described the EBA in the Near East as a period of urban development, with possible city-states developing across the Southern Levant (Savage et al. 2007; Chesson and Graham 2003; Finelstein and Gphna 1993; Pitard 1998). Theories about the Southern Levant city-states developed before the idea of urbanism and the correlation to cultural material was debated (Adams 1966; Flannery 1972; Philip 2001; Service 1962, 1975; Wright 1977). Currently, some scholars have begun to perceive the EBA I shift to more complex urban societies during the EBA II and III from a neo-evolutionary perspective (Philip 2001; Portugali and Gophna 1993; Richard 1987; Mazar 1990; and Esse 1984, 1989, 1991). According to Harrison (2011:281), one of the important aspects of EBA societies was that kinship and extended families were central to social and economic relationships throughout the region. Sites increase both in numbers and in size, shifting from village sites to larger sites (Harrison 1997). This increase in settlements throughout the EBA II has been the subject of research on numerous occasions (see Amiran 1969 and 1970; Kempinkowski 1978; Gophna and Portugali 1988; Esse 1989; 1991; Finklestein and Gphna 1993; Potugali and Gophna 1993; Joffe 1991, 1993; Falconer 1994a and 1994b; Harrison 1997, 2011).

In addition to settlement patterns, changes in economic and social organization led to the development of cultural and social traits that were distinct from the preceding period. More village sites began to appear during the EBA Newly developed mixed farming and animal husbandry became common along the Mediterranean region (Richard

2003; Philip 2001; Horowitz and Tchernov 1989; Grigson 1995). Furthermore, the region became more reliant on sheep, goats, and cattle to supply meat in addition to secondary products such as dairy, fiber, and wool. Larger animals such as cattle became common as draught animals for plowing fields and carrying heavy loads.

The geography and environmental variation of the region has influenced and affected local settlements and production patterns while altering economies, residential strategies, and site functions (McNutt 1999:37). It is typically thought that the developing complexity during the EBA I led to the development of city-states during the EBA II-III and the emergence of social and political stratification (Finkelstein 1995a and 199b; Philip 2001). This increase in settlements throughout the EB II (and EB III) has also been the subject of research on numerous occasions (see Amiran 1970; Kempinkowski 1978; Gophna and Portugali 1988; Esse 1989; 1991; Finklestein and Gphna 1993; Potugali and Gophna 1993; Joffe 1993; Falconer 1994; Harrison 1997).

Slight changes in settlement systems during the EBA III point towards nomadic or rural population across the Southern Levant. Richard (1987) explains these changes as being more associated with organization and production systems and not populations moving from a sedentary urban lifestyle to a nomadic way of life. These changes were more in the form of a movement from urban to non-urban pastoral production systems (Bates and Lee 1977). Finklestein (1989) argues against a two dimensional change during the EBA IV. Instead he looks at the different groups that were present and continued to exist. These include marginal nomadic groups, semi-nomadic groups, and pastoral nomadic groups.

The EBA IV presents a very interesting situation for Near Eastern archaeologists in relation to settlement patterns and sociopolitical climate. It is during the latter part of this period that urban decline on a regional scale occurred, with many of the sites being characterized by significant destruction layers (Richard 2003). Wright (1937) labeled the period EB IV, following Albright's (1932) early description of the period and Gluek's (1934, 1935, 1939, and 1951) assessment of the period. Populations shifted from cities to more rural settlements (Dever 1995; Richard 2003; Kenyon et al. 1971). By 2300 BCE, nearly a complete collapse of the urban cities occurred throughout the region. At that time, populations in both Jordan and Palestine became more pastoral in nature, moving between seasonal camps with a fewer settled occupations. However, one EBA IV site in Jordan, Khirbet Iskander, consisted of a wall around the large city, while the vast majority of other sites at that time were small in comparison (Richard 1983; 1987, 1990; Richards and Boraas 1988).

Dever's (1980, 1983, and 1985) model on pastoral nomadism is based on studies by Liverani (1970, 1973) and Rowton (1973) and considers new variations of settlement patterns during the EBA IV as a direct result of seasonal transhumance prevalent in Palestine and Jordan (Cohen and Dever 1978, 1979, 1981). Falconer and Magness-Gardiner (1984, 1989, and 1994) conclude that subsistence strategies evidenced at Tall al-Haygat and Tall Abu an Ni aj indicate that the pastoral nomad model alone does not account for the various types of economic strategies being employed during the EBA IV.

New urban and village sites begin to appear during the Middle Bronze Age (MBA) (Albrecht Alt 1968; Dever 1970, 1994). These changes suggest a move toward

more political consolidation. International trade began to increase between Egypt, Syria, Arabia, and Canaan, and was accompanied by the spread of technology (Illan 1995, 2003; Falconer 2001). The lack of archaeological material representing this period led Glueck (1970), during his regional surveys, to conclude that between the EBA and the Iron Age there were no permanent settlements throughout Transjordan. However, many historical Canaanite cities were founded during this period and sites began to spread through the region away from the coastal plain (Dever 1995, 1997; Ziffer 1990; Ilan 2003; Falconer 2001; Dever 1987). During the MBA I, the region consisted of small farming villages with pastoral nomads, similar to the EBA IV. It was during the MBA II and III that the strong shift back to urbanization began to occur (Falconer 2001; Ilan 1995, 2001; Dever 1992, 1987; Mazar 1990; Mazar 1968; Kenyon 1979; Gerstenblith 1983; Albright 1960). It is almost unanimously agreed upon that the MBA III coincides with the Egyptian Dynasties XV-XVII (Illan 2003). The end of the MBA II is marked by the destruction of nearly all MBA III sites in Palestine by the Egyptians, while the Ammorites took control of most of the Southern Levant during the MBA III (Albright 1933; Kenyon 1966; Mazar 1968; Illan 1995, 2001).

Significant sociopolitical changes that occurred at the end of the MBA affected the structure and overall character of Late Bronze Age (LBA) Canaanite society (Baumgarten 1992; Bunimovitz 1995; Strange 2001; Leonard 2003; Falconer 2001). The consistent contact and relationship with Egypt during the LBA significantly affected the cultures of the Southern Levant. Several authors have provided detailed LBA culture

history studies for the region (see Albright 1960; Kenyon 1979; Leonard 1989; Mazar 1990; Redford 1992).

During the LBA (1525–1175 BCE), Egypt controlled most of the Southern Levant (Gonen 1984, 1992; Falconer 1994). Widespread destruction layers have been documented throughout the southern Levant that coincide with evidence of the expanding international power of Egypt and the less structured political situation throughout the Southern Levant. All sites across the region appear to have been under complete Egyptian control during much of the LBA. Even so, cultural groups in the region did manage to forge their own identity, which can be seen in their material culture. Egyptian texts dating to the LBA make it the first historic period in Jordan. This transpired as the Egyptians began to view the region east of the Jordan River with interest. The LBA ended somewhat abruptly around 1200 BCE with the collapse of many Near Eastern and Mediterranean kingdoms. The main cities of Mycenaean Greece and Cyprus, and those of the Hittites in Anatolia and in Syria, Palestine and Jordan were destroyed.

The exact cause of the widespread destruction is debated. One of the more accepted theories is that "Sea Peoples" who were defeated by the Egyptian pharaohs Merenptah and Rameses III migrated from the Aegean and Anatolia and settled in Canaan, destroying many of the sites. An alternate theory for the widespread destruction may have been the Israelites movement into Palestine, which coincides with the biblical narrative. Although the archaeological and biblical narratives do not always correspond, there is evidence that the many Canaanite towns, including Ariha (Jericho), Ai and Hazor

were destroyed during this period. There is no historical mention of Madaba and, therefore, it is difficult to place the site in Bronze Age context.

Iron Age

The end of the LBA in 1200 BCE is marked by widespread destruction of sites. At the same time, the Hittite and Mycenaen empires in Greece collapsed, which resulted in the mass migration of "Sea Peoples" to the Southern Levant (Herr and Najjar 2001). Parallel to this migration was the emergence of widespread sociopolitical groups in the Levant consisting of the Israelites, Philistines, Ammonites, Moabites, and the Edomites (Stager 1998; Saur 1985, 1986). During the Iron Age (IA) (1200-1150 BCE), a number of large settlements emerged in Cis and Transjordan, mostly in the hill country. According to LaBianca (1994), tribal kingdoms began to take shape throughout the region of Jordan (LaBianca 1994). Supporting textual and archaeological information depicts this region as both geographically and ethnically diverse and a mosaic of complex societies, including Philistia, Phoenicia, Aram, Judah, and Israel to the west of the Jordan River and Ammon, Moab, and Edom to the east (Bienkowski and van der Steen 2001; Bunimovitz 1990; Faust 2006; Finkelstein 1997; Levy 2008, 2009; Routledge 2004; Stager 1985). Several models have been proposed to account for the development of the Israeli kingdom (Alt 1968; Finkelstein 1988; Younker 2003; Stager 2001; Mazar 1992; Miller 2004; Alt 1968; Mendenhall 1962; Albright 1935,1939).

The Iron Age is divided into three distinct periods: Iron I, II, and III. The Early Iron Age (1200-1000 BCE) saw major changes in the Southern Levant and throughout

Jordan (Harrison 2009). Sea Peoples, probably of Aegean origin, began settling in the Canaanite cities along the southern plain of Palestine (Finkelstein 1995a and b; Yonker 2003; Herr et al. 2002; and Najjar 2001; Wright 1959). Archaeological evidence suggests their arrival may have been violent, but they quickly adopted Canaanite culture, language, and religion. Canaanite cities to the north continued without significant changes, and eventually merged with the Phoenician culture. New kingdoms developed in Transjordan and the central highlands of Palestine. The kingdoms of Egypt and Mesopotamia reasserted themselves and eventually re-established their dominance over the small kingdoms and city-states of the southern Levant. By the time of the conquests of Alexander the Great during the Classical period, the southern Levant had been absorbed into the world-empire of Persia. Each of these historical events shaped the cultural landscape of the Near East.

At Tell Madaba, deposits associated with the IA that were excavated between 1996 and 2002 are mostly associated with the IA IIB (9^{th} and 8^{th} centuries BCE). This portion of the IA marks the beginning of a political-historical period: the era after the breakup of the United Monarchy founded by David and Solomon into the northern kingdom of Israel and the southern kingdom of Judah, referred to as the period of the Divided Monarchy. One major trend was the move in both kingdoms towards urbanization. Considerably more large cities were established during IA II than in the earlier Iron Age. Dever (1995:416) suggested that this trend in the settlement data indicates state level organization, with well-established hierarchies of subordinate settlements that had materialized out of the less cohesive political entities of the

preceding periods. For the most part, these newly founded city-states were competing with each other for trade and resources.

Other than the Northern Kingdom of Israel and the Southern Kingdom of Judah, the coastal kingdoms of Philistia and Phoenicia were intertwined in the ongoing struggles during IA II (Dever 1995:416). With these four political players in such close proximity, and the constant threat of invasions from both Egypt and Assyria, there was a continuous shift in allegiances between and among them. In particular, Israel and Judah were constantly involved in what can be classified as border skirmishes. Frequent attacks by Judah that were trumpeted as efforts to reclaim the northern kingdom of Israel were more likely motivated by the need to secure a buffer zone for Jerusalem, the capital city of Judah (Miller and Hays 1986: 234).

During the period of the Divided Monarchy, Israel and Judah were in conflict with outside kingdoms and tried to lay siege to them. The breakup of the Davidic Monarchy provided Shishak, Pharaoh of Egypt, an opportunity to attack Palestine in 920 BCE (Ahlstrom 1993: 557). His campaign went all the way to Megiddo in the Northern Kingdom of Israel. During this conflict it was only Israel that was weakened, due to the fact that Judah chose to pay Shishak a large tribute (Ahlstrom 1993:556). Although the invasion of Shishak was short lived, it did prevent Judah from successfully pulling Israel back under its control.

In 841 BCE, Shalmaneser III of Assyria attacked the Levant (Barkay 1992: 303). Despite the fact that it was an alliance that faced the Assyrians, it was Israel more than the others that suffered severe damage at the hands of the invaders. In fact, there are no

destruction layers attributed to the 9th century in the kingdom of Judah (Barkay 1992:307). Soon after this conflict, the kingdoms in Palestine once again resumed quarreling among themselves.

During the late 8th century, Assyria invaded once again, this time successfully penetrating the region of Palestine. In 733 BCE, Tiglath-Pileser III of Assyria destroyed Damascus and succeeded in taking over portions of northern Israel (Herr 1997:151). Phoenicia and Philistia fell to Assyrian rule the same year. This led to Assyria's control over all of the international trade on the eastern Mediterranean coast and directed a large flow of commerce into Assyria (Miller and Hayes 1986: 319).

The Assyrians, for the most part, left Phoenicia and Philistia as somewhat independent kingdoms. By doing this, the balance of trade that each region had established was not disrupted (Miller and Hayes 1986: 337). Once the Assyrians had conquered these areas, they forced them to pay tribute to help sustain the Kingdom of Assyria. Tribute was demanded in the forms of agricultural goods, livestock, and even people (Wapnish and Hesse 1991; Redford 1992). Thus large quantities of products were being grown, raised, and manufactured at one location and transported to another location. This tribute played a major role in the economy of the southern Levant.

Toward the end of the 8th century BCE several rebellions occurred in the areas that were supported by Judah. Assyria once again invaded to subdue the rebellions. Shalmaneser V led these invasions in 727-722 BCE (Mazar 1990:532). In 722 BCE, Shalmaneser V laid siege to Samaria, the capital city of Israel, and soon brought the northern kingdom to an abrupt end (Miller and Hayes 1986:318). Assyria continued to

launch invasions into the southern Levant, eventually weakening the power of Judah and transforming the area of Philistia into a cluster of vassal states, ones too weak to form any alliances capable of fighting back (Ahlstrom 1993:716). During the following period, the Persians occupied much of the Southern Levant. For the most part, the Persians maintained a peaceful transition from the previous Neo-Babylonian administration (Dandamaev 1989; Van de Mieroop 2007; Lipschits 2006; Carter 2003; Briant 2002: Bienkowski 2001; Hoglund1991; Stern 1984, 1990, 1995, 2001; Aharoni 1979). Although no significant Persian occupation has been recorded thus far at Tell Madaba, Persian pottery has been recovered at Tell Jalul (Ibach 1987; Brown 1991), suggesting a major Persian influence in the region.

Hellenistic/Roman/Byzantine/Islamic Periods

The Hellenistic period in the Near East is firmly established based on historical events at 332 BCE when Alexander the Great entered Phoenicia and proceeded to conquer the region (Applebaum 1989a,b; Greenspoon 1998; Hengel 2001; Braund 2003; Peters 1970). From 301 to 198 BCE, the Ptolemies gained an advantage and established themselves in Egypt and ruled Syria-Palestine. Following that time, the Seleucids, who were based in Syria, ruled from 198-63 B.C.E (Berlin 1997; Chamoux 2003). Much of the area of Jordan and Judea was not highly valued by the Greeks, except for the region's close proximity to the trade routes between Syria and Egypt. However, the Ptolemies developed a very prosperous merchant center in the Gaza region and excelled in minting coins (Rappaport 1970).

The Ptolemies (ca. 312 BCE) took control of Palestine while Syria and Babylon fell under the rule of Seleucus (ca. 312/311 BCE), and Lysimachus (ca. 315 BCE) controlled the western part of Asia Minor (Berlin 2003; Greenspoon 1998). There was a Phoenician connection with the trade system in place (Herbert 1994; Berlin 1997; Stager 1991). Peace and political stability throughout the region characterized the Ptolemic rule in the Southern Levant (Avigad 1984; Avi-Yonah, M. 2002). Regions outside Egypt, under Ptolemic control (Syria, Cyprus, Cyrene, and the Aegean), functioned mostly as a defensive zone protecting their interests in Egypt (Ager 2003).

The first major contact between Palestine and Rome began in 63 BCE, but the Near East did not come under full Roman control until 106 CE, when the Nabataean Kingdom was removed and replaced with a Roman Province (Parker 1986, 1987, 1997, 2000, 2006; Khouri 1988; Hammond 1973). It is generally understood that the Byzantine Period begins in 325 CE at the founding of Constantinople as the Eastern Empire's capitol (Freeman 2001). During the Roman Period, Jordan eventually became part of the Arabian Province. The Arabian Province extended from the Red Sea in the south to southern Syria in the north. Palestine and Arabia were never as economically important to the Romans as other provinces in the region. Only a narrow stretch of fertile land along the Mediterranean coast of Palestine was considered a valuable resource (Freeman 2001). Settlement pattern data suggest that most of the population in the Arabian Province lived along the northwest edge of Jordan and in southern Syria (Parker 2000).

The Roman military began constructing roads and completed the Via Nova Triana (Trajan New Road) in 111 CE Also known as the King’s Highway, the Via Nova Triana

stretched from the port of Aqaba in the south to the Syrian city of Bosra in the north (Bowersock 1983; Graf 2003; Schmid 2001; Parker 2000). Several areas contained resources, which were exploited by the Romans. Copper was mined at Wadi Araba and bitumen and salt were extracted from the Dead Sea (Parker 2000). The area functioned mostly as the landmass between two economically and politically more important provinces: Egypt and Syria (Freeman 2003; Parker 2000; Anderson 1995).

Rome significantly restructured the Near East region, which had major consequences for the southern Levant. New provinces were established and the land was divided into various client-kingdoms. Each client-kingdom was expected to adhere to Roman rule. Typically, a local ruler appointed by Rome governed each client-kingdom. However, Rome controlled all foreign affairs and provided military support. As long as the client-kingdoms followed Rome's demands, some autonomy was allowed, in addition to Roman protection from external threats (Levine 1998). Inscriptions support the view that Madaba remained within the Nabataean cultural and political sphere until the region was incorporated into the Roman Province of Arabia (Provincia Arabia) in 106 CE, following Trajan's defeat of the Nabataeans at Petra.

The Nabataean Kingdom, or period, coincides with the Hellenistic and early Roman periods. During the Hellenistic period, the Nabataean Kingdom began establishing itself in Transjordan with its capital at Petra, and by the Early Roman period the kingdom was completely entrenched. It became one of the more prominent entities in the region, and during its height the Nabataean Kingdom stretched as far north as southern Syria, throughout most of Transjordan, into the Negev of Palestine, and into

Saudi Arabia. The Nabataeans were known for their ability to control pasture throughout the arid deserts and dominate the spice trade (Studer 2007:251). Consequently, the Nabataeans became important players in the Hellenistic and Roman empires, both economically and politically (Schmid 2001; Graf 1990; 2003; Patrich 1990).

The Byzantine Empire remained culturally, politically and socially similar to the preceding Roman period. Jordan was basically divided into four Byzantine Provinces that extended into Palestine, Syria, and Arabia (Watson 2001; Jones 1973). Other than the newly founded capital, Constantine's conversion to Christianity in 333 CE also altered the religious and cultural landscape of the empire (MacMullen 1984; McManners 1990; Patrich 1995). Most populations in Roman cities of the Near East, including Transjordan, increased during the Byzantine period, and significant growth and construction occurred throughout the Near East and the Arabian Province (Patrich 1995; Geller 1998; Watson 2001; Meyers 1982, 1997). Many churches were constructed in the provinces, with many built on top of older temples and religious structures associated with the Romans (Watson 2001).

Eventually, the Byzantine Empire became engulfed in protecting its interest in Constantinople and the surrounding area and trying to regain control over the western part of the empire, including Rome. This preoccupation weakened the empire’s forces and eventually led to the removal of the Byzantine occupation from the Near East. Earthquakes and other natural catastrophes continued to weaken the fragile empire (Whitcomb 2001; Meyers 1997). Soon, the Byzantine Empire was replaced with a more collectively focused entity from the Islamic occupations.

Damascus fell to Muslim rule in 635 CE, and the last major conflict between the Byzantine and Muslim armies occurred in 636 CE at the Battle of Yarmouk in Jordan (Whitcomb 2001). The Byzantine army was overwhelmingly defeated and the Muslims arrived in Jerusalem in 638 CE. Once Jerusalem was under Muslim control in 642 CE, the invasion of the eastern provinces was complete (Kaegi 1992). During the Ayyubid period, Salah al-Din implemented the destruction and abandonment of the coastal cities in Palestine, which was a stronghold of the crusader kingdom (*ibid).* This led to most cities, from Tyre to Gaza, being completely destroyed (Ayalon 1967; Rosen-Ayalon1995). This destruction continued with the Mamluks, and was so severe that the coastal region remained unpopulated for several centuries (Rosen-Ayalon 1995:515).

Because the majority of battles between the Byzantine and Islamic armies were fought in the countryside surrounding the cities, very little archaeological evidence associated with the Muslim conquest has been recorded. Many cities surrendered peacefully and therefore were not attacked and destroyed (Schick 1992, 1994). Peaceful transaction with the stronger invading forces was more prudent than facing the devastation if they resisted.

Archaeologically, the Islamic Periods in the Near East were severely neglected in the past (McQuitty 2001; Walmsey 2001; Whitcomb 2001). However, interest in Islamic archaeology, especially in Jordan, has increased significantly (Whitcomb 2001: 503). Based on the archaeological record and historical documentation, the Islamic period has five major subdivisions: Umayaad, Abbasid, Fatamids, Ayyubid/Mamluk, and Ottoman (Walmsley 2001).

After the Islamic conquest and the development of the Umayyaad Caliphate during the mid-7th century, Madaba appeared to have flourished (Harrison 1997). The town continued to function as the seat of bishopric and several Byzantine churches were renovated. Mosaics in the Church of St. Stephen list two bishops from Madaba during the Abbasid Caliphate: Job in AD 756 and Sergius II in AD 785 (Piccirillo 1987: 180-86). Unfortunately, other events documented by the Caliphates in the region of Madaba do not mention the site (Hutteroth and Abdulfattah 1977). However, Madaba remained a major site in the area for Christians. Literary sources do not mention Madaba from the 8th century until the early 19th century when westerners began exploring Transjordan (Harrison 1996b). Furthermore, there is no mention of Madaba in the early Ottoman tax records (Hutteroth and Abdulfattah 1977).

From this brief summary it can be seen that several distinct periods and cultural entities emerged in the southern Levant. During each of these periods the region was engulfed in significant power struggles and subjected to numerous invading forces. It is uncertain if Tell Madaba was an autonomous community maintaining its own administrative power, or one under the control of a larger, local or regional administrative center. The emergence of various factions and empires dramatically affected the entire southern Levant. Kingdoms were transformed into vassal states, and economic pressure was placed on the production system that supported the site. In response, adaptive strategies employed by the settlements should be reflected in the animal production and distribution systems that supported Tell Madaba.

CHAPTER 5
NEAR EASTERN ZOOARCHAEOLOGY: HISTORY, MODELS AND THEORIES

Zooarchaeology is multidisciplinary in nature, combining the fields of biology, zoology, archaeology, history, taxonomy, and anthropology (Wapnish and Hesse 2003). The use of faunal remains in reconstructing subsistence strategies is an important aspect of every archaeological project. Animal remains are a visible and significant component of the archaeological record and provide insight into processes that affect human adaptation. As a source of nutrition and resources, animals have been a part of virtually every human society. As a result, animal bones are routinely found in high frequencies in archaeological sites. In complex Near Eastern urban sites, animal bones are second only to pottery in recovered artifact quantities. Because of the ubiquitous distribution and use of animals in human prehistory and history, they are an important avenue for investigating human adaptive strategies and economic systems reflected in the archaeological record. Therefore it is crucial for zooarchaeologists to understand the human-animal interaction in a broad cultural and environmental setting to gain insight into adaptive strategies, and to ascertain information about the motives behind these interactions between humans and animals.

The field of zooarchaeology extends beyond the study of ecological and environmental conditioning into sociocultural aspects of animals within human adaptation (Wapnish and Hesse 2003; Russel 2012). Zooarchaeologists have come to understand that animals not only served a biological need, but also that humans conceptualized animals in specific ways, not just as a biological necessity (Russel 2012).

Using both ethnographic and archaeological data, Russell (2012) provides a holistic view of human and animal interactions within the realm of symbolism, rituals, hunting, extinctions, domestication, pets, diet, and wealth. Faunal data can impart more than just the range of species consumed by a particular community (Grayson 1973, 1979, and 1984; Wapnish and Hesse 1991). Statistical measures on distribution patterns can illustrate information that reflects decision making processes with direct social, economic, and political implications (deFrance 2009; Hesse and Wapnish 1985, 2001; Stein 1992; 1987, Crabtree 1990, Zeder 1988; 1991; Grantham 1992; Reitz and Wing 1999; Russell 2012). Analysis of slaughter and butcher patterns and the manipulation of herd organization and composition, for example, can reveal dietary preferences and the guiding priorities for choices in subsistence strategies, and the level of specialization and organization needed to accomplish them in addition to the social ideology behind those decisions (Marciniak 1999, 2005, 2011; Russell 2011; Hesse and Wapnish 1985, 2001; Wapnish and Hesse 1988; Lev Tov 2001; Griffith 2001; Zeder 1994, 1991). When compared through time, small and large-scale changes in the faunal assemblage can reflect cultural and social priority shifts that controlled food production. Information extracted from these analyses provides necessary and complementary site interpretations.

Near Eastern Zooarchaeology

The research presented herein investigates different strategies applied to animal production and distribution systems as they pertain to human adaptive strategies within broader economic, political, and geographical aspects associated with Near Eastern urban complexes and how they evolved over time. Hence, it is not the intent here to provide a

re-hashed historical view of zooarchaeology, which several researchers have so eloquently done (see Reitz and Wing 1999 and Simon 1987). However, in order to place this study within the broader historic periods of Near Eastern zooarchaeology, a brief account of some of the more important historical and developmental aspects are discussed.

Zooarchaeology has become a significant part of Near Eastern archaeological research over the last 50 years. The rate at which zooarchaeological data have been incorporated into larger Near Eastern site reports has improved significantly (Brothwell et al. 1978; Hesse and Wapnish 1985; Reitz and Wing 1999; O'Conner 1996, 2000, and 2001; Rackham 1994). This, in part, is owed to the recognition of faunal material on an ecological, environmental, and cultural level. It has become more common for archaeologists to design field methods, theories, and models with the inclusion of faunal data, and many projects now employ a trained zooarchaeologist on site during excavations. These advances have contributed significantly to the understanding of past cultural adaptations and lifeways involving animal production and distribution systems. However, zooarchaeology is still considered somewhat of a peripheral field providing complementary data to the study of past environments and ecological questions. This is not to imply that the work of zooarchaeology is considered unimportant in current archaeological thought. On the contrary, it is recognized not only as important, in some cases, crucial to the development of archaeological methods and theories. Unfortunately, even today many faunal reports are still basic technical lists and usually get relegated to an appendix in larger site reports.

Zooarchaeology developed as a need to identify large quantities of bone that were being discarded during site excavation and considered of little importance to overall site interpretations (Hesse and Wapnish 1995, Kansa et al. 2007). Initially these studies generated descriptive text and classifications of animal bones, placing them into simple lists or categories. According to Reitz and Wing (1999) one of the earliest zooarchaeological studies was in the 1700s; however, zooarchaeology did not emerge as a subdiscipline until the 1860s. Scientific methods were not routinely applied to faunal assemblages until the development of the New Archaeology during the 1960s and 1970s (Thomas 1996). In other words, prior to processual archaeology little attention was given to the cultural aspects of the relationship between animals and past cultures. The New Archaeology focused more on ecological aspects of animals and human culture. Few archaeological projects included any analytical information about the socio-cultural aspects of faunal assemblages.

Initially, most researchers conducting zooarchaeological research had zoological backgrounds and interest that were more in the biological and morphological aspects of the animals. Also, the paradigm of environmental determinism strongly influenced their work. More specifically, those involved in the early phase of zooarchaeological research relied on the idea that the environment played a major role in directing culture and categorized humans as passive participants controlled in large part by ecological and environment conditions (Crumley 1994; Ellen 1982; Hardesty 1977; Reitz and Wing 1999; Wapnish and Hesse 1991).

Beginning in the EBA, urban centers began to develop across the Near Eastern landscape (Finklestein 1995; Zeder 1991; Hesse and Wapnish 1995; Esse 1984, 1989, 1991, and 1993). Urban development in the region affected each aspect of cultural development, including animal production systems (Kansa et al. 2007; Wapnish and Hesse 1988). Domesticated animals became very important, with pastoralists maintaining herds that supported animal production and distribution systems throughout the Near East.

The faunal assemblage recovered at Tell Madaba is made up almost entirely of domesticated animals. To further add to the complexity of archaeological analysis, Tell Madaba had grown into an urban site by the EBA and was intertwined in the local and regional social and geo-political climate. The effects of urbanization and large-scale geo-political issues served to formulate a short list of barnyard stock animals, but a very complex archaeological assemblage. Fewer species does not equate to simpler systems. On the contrary, simply listing these few species would not provide information about the complex social and economic features affecting the animal production system during specific cultural periods. Near Eastern zooarchaeologist had to adapt and reorganize archaeological theoretical models to account for large and small-scale environmental and sociocultural implications affecting the relationship between animals and ancient humans.

Zooarchaeology in the Near East was initially directed by historical and biological or zoological studies (Trigger 2006; Knapp 1992; Hesse 1995). Emphasizing the study of animal bones in an historical and/or biological matrix, most practitioners were trained in Biblical/historical fields or the biological/zoological fields (Hesse 1995). During the

second half of the 20th century, more ecological approaches associated with the New Archaeology or Processual Archaeology began to develop. These approaches applied a more rigid scientific perspective to the field of archaeology (see Pike and Gitin 2002; Trigger 2006). Ecological issues and cultural ecology moved to the forefront of archaeological research. Zooarchaeology followed suit and began to produce more biological and environmental interpretations (Hesse 1995:198). However, scientific approaches continued to give way to more historical and cultural history studies in Near Eastern archaeology (Hesse 1995:197). Even today, much of this work is still closely connected to "Biblical Studies" and has been less reliant on scientific approaches. Recently, however, more Near Eastern and Middle Eastern archaeologists are embracing scientific and multidisciplinary studies in their approach to excavations and interpretations.

During the 1980's and 1990's, new theoretical schemes developed with the advent of "post-procesualism" or interpretive archaeology (see Hodder 1986; Trigger 1989). These ideas developed as a backlash to the restrictions generated by the rigid interpretations of processual archaeology (Hesse 1995:205; Reitz and Wing 1999; Trigger 1989). Until recently archaeologists studying in the Near East had been reluctant to accept these new approaches over more historical interpretations. This is the result of reliance on historical models prevalent in Near Eastern and Middle Eastern Biblical archaeology (Hesse 1995:197).

Archaeology of the later historic periods has undergone significant changes in the past several decades, and the application of new theories and excavation techniques have

led to more extensive data recoveries and added a wealth of knowledge to interpretations. The field of zooarchaeology has also been subject to new concepts and theories. However it is still very common for faunal studies to be relegated to the appendices of larger site reports without any attempt to integrate the findings into site interpretations. This is unfortunate since many researchers have demonstrated that a wealth of information can be ascertained from patterns observed in faunal remains recovered from Near Eastern contexts (see Hesse and Wapnish 1985; Zeder 1991; Grantham 1992; Griffith 2001).

Zooarchaeological Taphonomic Issues

Animal production systems, whether associated with hunter gathers or with complex domestic production systems, are reductive in nature. Animal bones that end up in Near Eastern archaeological assemblages have been subjected to a vast array of attritional processes before and after they were deposited (Andrews 1995; Koch 1989; Hesse 1982; Hesse and Wapnish 1985; Behrensmeyer 1978; Olson 1980). Large-scale urban continuity contributes significantly to these processes at Near Eastern urban sites. Additionally, animal husbandry is a deductive process, whereby species and individuals are chosen and culled and cuts or carcass parts are distributed to various locations, and finally bones are discarded. The herds are usually raised away from the site, while the carcass parts are distributed throughout the site. Each stage along this trajectory between herding and consumption can serve to deduce the skeletal elements present at a given site. A complex web of factors affects this system and ultimately determines which bone elements eventually end up in the archaeological context.

Many processes affect and destroy bones before and after they are introduced into the archaeological record, and there are attritional processes that affect the bones after they are recovered. In order to provide a perspective, faunal assemblages from an archaeological site represent only a fraction of the entire herd available or culled during the time of occupation. In other words, the faunal assemblage available to a zooarchaeologists is a small sub-sample of a small sub-sample of a small sample of all the animals available and slaughtered and the carcass parts and discarded bones. The list of processes animals go through in order for their bones to end up deposited and recovered from sites can be extensive. Those processes that affect bones within archaeological sites must be studied in order to gain a more complete picture of the animal production system. How and where carcass parts are distributed are significantly affected by cultural and natural processes.

An archaeological site is a dynamic entity, and in some cases artifacts buried within a site can completely disintegrate (Schiffer 1987). This is especially true for organic material such as plants and bones. Taphonomy, which is the study of these processes, was first utilized in paleontology (Efremov 1940) as a means to assess how and why certain bones or animals were included in the fossil record while others were not. The study of these processes found its origin when the need to describe fossil remains pushed researchers to study how osteological material is affected when an animal is removed from the living assemblage and deposited into the lithosphere (Behrensmeyer 1984; Bonnichsen 1988; Kotch 1989; Lyman 1994; Reitz and Wing 1999).

The formation of a site is complex and includes the entire history of the site in addition to external regional factors. Natural and cultural processes shape both the sedimentary deposits in an archaeological site and the artifact assemblage contained within the site matrix (Behrensmeyer 1993; Lyman 1994; Schiffer 1987; and Hesse and Wapnish 1985:28-31). Schiffer (1976, 1987) described the archaeological record as signals resonating from natural and cultural processes that affect the artifacts and features contained within the site. Zooarchaeologists have extensively studied these processes (see Clark and Kietzke 1967; Klein and Cruz-uribe 1984; Hesse and Wapnish 1985; Davis 1987; Bonnichsen 1988; Behrensmeyer 1993; Lyman 1994).

Both cultural and natural processes significantly affect the bones throughout each stage of production, processing, and discard. The basic question that must be addressed is simple: what happened to all the bones? In other words, the processes that affected the living organism and slaughtered animal, as well as those processes that affected the discarded bones over hundreds or thousands of years, must be considered.

Taphononomic processes affect each animal element differently (Lyman 1994). Hesse and Wapnish (1985:20-31) developed an expansive model, taken from Clark and Kietzke (1967), to illustrate the various taphonomic processes that affect a faunal assemblage throughout its history. Reitz and Wing (1999) describe in detail Cribb's (1985) division of these processes. Below is a brief discussion of some of the models presented for the study of taphonomic processes.

There are numerous models used to illustrate the processes that affect the living animals and the archaeological remains found within sites (Reitz and Wing 1999; Lyman

1994, 2002; Schmitt and Lupo 1995, 2008; Bartram et al. 1991; Grantham 1992; Bonnichsen 1989; Davis 1987; Hesse and Wapnish 1985; Cribb 1985, Noe-Nygaard 1988; Gifford 1980 and 1981; Olson 1980). Most models separate various assemblages into general life, death, and deposited categories, with deposited assemblages being associated with several other categorical assemblages, and finally the faunal assemblage that archaeologists excavate and collect (Gifford 1980, 1981, Bartram et al. 1991, Reitz and Wing 1999:110-111).

Herds consist of entire populations of animals available as resources in a given area. Once they are selected and hunted or herded, they are then slaughtered and become part of the death assemblage, which consists of whole animals. After slaughter, the reductive processes begin. At this point, various carcass parts are separated, processed, and distributed in many different ways. In most cases these are not equal distributions and can be biased toward certain species or elements (cuts of meat). The initial group or assemblage is very diverse and contains all of the individual animals chosen for hunting, herding, or slaughtering. With each successive assemblage, the number of individual animals, carcass parts, and bones decreases. Hence, the faunal assemblage reflects a small, often biased, picture of the ancient animal production system. It is therefore important to understand the many processes that affect each assemblage.

Since ancient Near Eastern animal production, distribution, and consumption systems can be classified as reductive in nature, there is an abundance of natural and cultural processes that can affect the faunal assemblage. The reductive processes that occur between the lines of production and consumption significantly alter the make-up of

the initial discarded faunal assemblage. These processes determine which species are exploited, the culling age and carcass parts, and even where to discard the remains. Cribb (1985) describes three processes that affect animals used in ancient subsistence and zooarchaeology: systemic, archaeological, and analytical. The processes that affect the animals during their lives and throughout the production process are classified as systemic. The process of burial or depositing bones into the archaeological record and those of the archaeologist excavating the site can be classified as archaeological processes. The analytical processes affect bones after excavation and when the zooarchaeologists are working on them in the laboratory and even up to writing the report. The analyst can control some of the processes within the realm of the archaeological and analytical phase (Davis 1987:22-46). However, those processes that affect the bones prior to recovery are completely out of the control of archaeologists (Hesse and Wapnish 1985:20-31).

There are basically two broad categories of taphonomic processes that affect an archaeological site. First, there are numerous processes that affect the faunal material long before archaeologists excavate and expose them. They are known as "contributional biases" (Grantham 1992), "first order processes" (Reitz and Wing 1999), or "systemic biases" (Cribb 1985). These processes are responsible for contributing animals or bones to the archaeological record. Before an animal is culled or butchered, contributional biases affect the decision-making processes for both the herders and the consumers. Recognition, availability, costs, and demands of an animal's importance as a resource plays a significant role in determining which animal species end up in the archaeological

record. Some of the decisions concerning which animals to use can also be related to symbolic meanings (Rapport 1967; Russell 2011, 1999). Even prior to the decision making process, the natural environment determines which animal species are available as resources.

Second order changes affect archaeological decisions and research conclusions about faunal assemblages (Reitz and Wing 1999). Decisions such as where to place excavation units and how many units to excavate as well as sampling decisions and recovery methods can determine the relative recovery of bones and other material (Gautier 1984:240). Determining whether or not to implement a screening protocol and what size mesh should be used can affect bone recovery rate and size, respectively. These processes affect the recovered assemblage and can alter interpretations of architectural units, site function, and even regional economic and political changes.

Hesse and Wapnish (1985), Wapnish and Hesse (1988), Hesse (1995), and Wapnish (1995) have conducted numerous studies throughout the Near East and Middle East, and have developed several animal production models for the later historic periods, along with taphonomic models that are applicable to later historic sites in the Near East. They list several distinct processes, both natural and cultural, that affected osteological remains at archaeological sites, including Thanatic, Perthotaxic, Taphic, Anataxic, Sullegic, and Trephic (Hesse and Wapnish 1985:20-31). Several other researchers have discussed each of these processes, but Lyman (1994) presents one of the most detailed taphonomic studies.

Biotic processes are environmental conditions or variables that set limits on which animal species are present in particular ecosystems and regions. Animals must first be available in order to be utilized as a resource within a particular community. However, archaeological and paleoenvironmental studies have shown that availability of animal species does not signify utilization. In any subsistence economy an animal must first be perceived as a resource. There is a plethora of factors that can affect this decision and exclude certain animal species. Those factors, ranging from religious beliefs to the lack of recognition of a reliable resource, can play a significant role in urban societies that rely on domestic stock for resources (Hesse and Wapnish 1985:20).

Once an animal is recognized as a resource, it is selected for utilization. The processes that remove animals from the living population or herd and convert them to food resources, thereby making them available for deposition in the archaeological record, are Thanatic Processes. The choice placed upon herders as to which animals to cull in an animal production and distribution system is one of the more important Thanatic Processes for later historic period sites in the Middle East. Production strategies must first be acknowledged and implemented. This includes meat, dairy and, fiber production, or some combination of the three (Payne 1973, Cribb et al. 1987). These strategies can and usually are driven by market demands or political pressure for certain species, age of animals and cuts of meat and significantly affect the assemblages found within animal production systems (Hesse and Wapnish 1985:20-23).

After an animal has been slaughtered, Perthotaxic Processes begin to affect the remains before it has been deposited or buried. These processes are the first to degenerate

carcass parts and bones. Once animals are slaughtered, they may be consumed, or the carcass divided into sections based on which cuts or parts are most desired or in demand. The parts may then be distributed throughout the community in different ways. Within the context of urban sites in the Near East, remains or cuts from a single animal are sometimes widely scattered within and between sites. Furthermore, some carcass parts may be consumed quickly while others are stored. Discard piles away from domestic dwellings can become a buffet for scavengers such as dogs and pigs. The scavangers may gnaw and disperse bones from the same animal across large spatial areas, even removing some remains from the site entirely (Hesse and Wapnish 1985:23-26). Weathering also plays a major role in bone surface deterioration.

Once bones are deposited into the archaeological record and become buried, they are still subjected to processes that continue to deteriorate bone and destroy information. These are known as Taphic Processes and include mechanical and chemical actions that break down or affect preservation. Extreme cold or heat can play a major role in the mechanical breakdown of bones in any buried context (Wood and Johnson 1982). Bones also can dissolve, breakdown, and mineralize or crystallize, depending on the chemical processes in the sediments and soils that contain the bones (Hesse and Wapnish 1985). In some cases, a high percentage of bones may partially or completely deteriorate, providing an incomplete picture of the original faunal assemblage (Hesse and Wapnish 1985:28-29). Root etching and sedimentary abrasion can also deteriorate bone surfaces.

After bones are buried they can be re-exposed to the surface and subject to numerous Anataxic Processes. Near Eastern tell sites are a chronological conglomerate of

different cultures and communities that would tear down existing structures, borrow material, and construct cities and towns. In several cases mud bricks have been found to contain high levels of bone in the matrix that have been shown to originate in earlier occupations (Hesse and Wapnish 1985). Burrowing animals also push bones up to the surface from their buried context. Soil erosion by wind and water also can expose buried bones and other artifacts. Burying and re-exposing bone to the surface elements can be extremely detrimental and cause the bone to weather and deteriorate (Hesse and Wapnish 1985). Additionally, root etching and sedimentary abrasion can significantly modify bone surfaces.

As a result of cost and time restrictions, sites are seldom completely excavated, and more often than not, most of the site is left untouched. Selective processes archaeologists use to determine where and how much to excavate are Sullegic Processes (Hesse and Wapnish 1985:29-30). Excavators will not always collect bone material as meticulously as other cultural materials found during excavations. In some cases, sites are excavated with no screening of matrix protocol. Instead, materials are hand picked out of the sediment. This scenario tends to be biased toward larger bones from larger animals; hence the bones of smaller animals may be under-represented (Cannon 1999; Payne 1972). In other cases, all excavated matrix is passed through 1/4 inch or 1/8 inch screens. Furthermore, an archaeologist's ability to distinguish bone from other material plays a minor role in how bone is collected (Hesse and Wapnish 1985:30).

Once bones have been recovered, they continue to be exposed to many taphonomic processes. Different Trephic Processes affect the bones once they have been

removed from an archaeological site. Determining which categories of bones or species are important and how bones are labeled is crucial, and errors are often made in the recording process. Field identifications are sometimes dubious because of the fragmentary nature of some assemblages. Nonetheless, bones must be preliminarily identified and packed for shipping to universities and institutions for further analysis. The trip is sometimes very arduous, and almost always results in fragmentation of fragile bone. Upon arrival at the destination, the climate may be considerably different from where the bone was collected. All of these factors can have a negative effect on the bone material (Hesse and Wapnish 1985:30-31).

Measuring the magnitude of taphonomic processes or disturbances can be a daunting task for zooarchaeologists. However, by accounting for these processes, a few observations and calculations can assist in understanding the faunal assemblage as a whole and estimating the degree to which it has been affected. Assessing the condition of the recovered remains within a deposit and accounting for articulated skeletons and bones in anatomical relationship can indicate whether the deposit has maintained some level of integrity.

One of the more important comparisons for determining the degree of taphonomic disturbance and collection bias is calculating the ratio between identifiable bone, long bone shaft fragments (LBSF), and scrap (non identifiable) (Wapnish and Hesse 1988:83). This measure can provide a guide for determining the level of deterioration in a faunal collection. For example, when using a strict screening protocol, a zooarchaeologist assumes that most bone from small and large mammals was recovered from a given

excavation area. Also, assuming that bones are subject to significant deterioration in certain circumstances, there should be an increase in the number of specimens from identifiable bones to LBSF and then scrap

Understanding taphonomic processes that affect osteological material is crucial for any zooarchaeological study. Those processes can alter an assemblage drastically, resulting in a decline in the integrity of bones and information. Assessing the processes and their effects on bone at each stage can provide archaeologists with a glimpse into the animal production and distribution systems of ancient communities, and allow limited inferences about the relationship between people and animals that sustained these ancient cities.

Ancient Near Eastern Urban Faunal Assemblages

Using the concepts provided by Reitz and Wing (1999), Hesse and Wapnish (1985), and Lyman (1994a, 1994b; 1994c) in association with ancient animal production and distribution systems that sustained Near Eastern historic period sites, a minimum of nine Near Eastern Urban faunal assemblage groups can be identified. Several of these groups are defined by Reitz and Wing (1999) (**Table 5.1**). Each assemblage group is associated with various stages along the trajectory from living animals to the recovered faunal remains excavated at a given site. Particular processes affect each group, although they are not mutually exclusive. For example, once an animal is slaughtered it can then move through a single taphonomic assemblage or more and can be affected by numerous attritional processes throughout its history. Additionally, several of the taphonomic processes discussed earlier can affect a single faunal assemblage or multiple assemblages.

These faunal assemblages are categorized within two broad groups: sociocultural processes and archaeological processes. These assemblage groups are not concrete and may be intertwined within the broader scheme of zooarchaeological analysis. Sociocultural assemblages are those present at the time of occupation and are directly affected by a host of anthropological aspects, such as cultural, economic, political, and religions realms of the community, and include decisions made by communities as to which animals to raise, where to raise them, and which culling strategies to use. Archaeological processes are those that affect the bones after they have been introduced into the archaeological record. These processes may continue to alter the bone. Minerals and chemicals in the deposits can break down osteological materials, and the actions of the excavators, archaeologists, and even the zooarchaeologist can affect the faunal assemblage.

Sociocultural Processes

The herd is associated with pastoral animal production systems and includes management of single or multiple herds. Herd size can vary depending on economic and social factors surrounding the group. Some pastoral groups will maintain a single species herd while others may have multiple herds consisting of various animal species such as sheep, goats, and cattle. Taphonomic processes affecting this assemblage are those associated with first-order, biotic and/or thanatic processes. The herd will contain every live animal raised within the animal production system. Within this group, every animal in the herd has a statistical chance to end up in the faunal assemblage recovered from a given site. However, as discussed earlier, this is not the case.

Table 5-1. Faunal assemblages					
Assemblage	**Location**	**Characterization**	**Taphonomic Processes**		
			Reitz and Wing	**Grantham**	
Slaughtered Assemblage	Off site or near site	Specific Animals/whole carcasses	First-order	Contributional	Sociocultural Processes
Butchered Assemblage	Site location	Divided Carcass	First-order	Contributional	Sociocultural Processes
Market Assemblage	Site location	Specific animals/ages/cuts	First-order	Contributional	Sociocultural Processes
Distributed Assemblage	Dispersed	Social/Economic Segregation	First-order	Contributional	Sociocultural Processes
Preparation Assemblage	Site location	Based on culinary demand	First-order	Cuisine	Sociocultural Processes
Discard Assemblage	Dispersed or locus specific	Dispersed?	First-order	Cuisine	Sociocultural Processes
Deposited Assemblage	Dispersed or locus specific	Dispersed Discard	Second-order	Deposited Cuisine	Archaeological Processes
Archaeological Assemblage	Dispersed or locus specific	Recovered Faunal Assemblage	Second-order	Archaeological Cuisine	Archaeological Processes

The slaughtered assemblage will contain those animals selected or slaughtered for market resources or for distribution within the communities. This will entail whole carcasses. Decisions about which animal and what ages to slaughter will affect the make-up of this assemblage. If the herd managers dictate what to distribute for food, then the harvest profiles should contain older animals, after their use for by-products, such as wool and dairy products, has diminished. On the other hand, if a market-based system dictates food distribution, then more “market-age” animals will be identified for slaughtering processes.

After animals are slaughtered, they are then butchered and carcass parts distributed. The butchered assemblage will contain all carcass parts prepared for distribution, following the trimming processes. Some carcass parts may be discarded or set aside at this point, while others are prepped for markets or distribution. Both high value (usually high meat to bone ratio) and low value (usually low meat to bone ratio)

bones will characterize this assemblage. The assemblage is significantly affected by decisions about which cuts of meat to use and the species and age of animals to be slaughter. In some cases, the carcass will be separated into "slaughter-offal" and "butchered-offal" (Hellwing and Gophna 1984). Slaughter-offal consists of those less desired parts that will sometimes be discarded during the butchering process, while butcher-offal consists of those parts desired by or provided to the community for food. As Grantham (1992) has illustrated, meat to bone ratios do not always dictate which carcass parts are more valued. Through ethnoarchaeological work among the Druze in northern Israel he showed that the head was valued for certain celebratory meals and therefore could not be dismissed as "slaughter-offal," which was the case for many archaeological assemblages in the area.

In some animal production and distribution systems, animals or carcasses may be distributed to a market, which will in turn sell or distribute the various cuts. This market assemblage will contain those parts that are desired or ultimately distributed to the consumers. Higher percentages of those specific carcass parts from certain species that are desired will characterize this assemblage.

At this point along the trajectory of faunal assemblages, carcass parts will have been distributed to the consumers or the community in general, thereby creating the distribution assemblages. These assemblages can be broken down into several sub-categories. First, there will be the site-specific assemblage that includes all the carcass parts delivered to and distributed within a particular community. Location, economics, politics, and sociocultural aspects will affect the make-up of this assemblage.

The next group is slightly more difficult to distinguish since it can be household specific or can be location specific. The preparation assemblage will contain those parts that individuals use in preparing and cooking meals, which is affected by the numerous decisions made about what meals to create or cuts of meat to use. This assemblage can be household specific or dictated by a host of external factors originating among ruling urban centers and markets determining the distribution of goods and products. This assemblage contains insight into the sociocultural aspect of site-specific consumption and economics derived from animal production systems at ancient Near Eastern sites.

The discard assemblage contains all of those bones from the various carcass parts that were prepared or used in making meals. From the context of this group it is easy to ascertain that a broad range of taphonomic processes begin to occur and can significantly deteriorate the bones. Also, discard can be household or site specific depending on a host of factors dictating the location of discarded waste. In some cases, discard piles can be located just outside a house, usually away from entrances. In larger urban complexes, waste or dumpsites can be found as nearby as alleyways or in specific trash piles away from major dwellings. The initial discard assemblage, which consists of those bones and scrap removed from the "kitchen table" to be discarded, may or may not end up in the same place. For example, some of the smaller bones and fragments may end up on the floor to be swept out later, while the larger bones may be taken immediately to the discard area. Regardless, sociocultural processes dictate the character of this assemblage. It is at this stage that scavengers can severely damage bones by gnawing and the elements can weather and erode bone surfaces.

Archaeological Processes

After discarding, there are a number of factors that determine whether bones are buried within the site. Once the remains become buried, they are associated with the initial deposition assemblage. This assemblage is subject to a wide variety of sedimentary abrasion and bioturbation processes that can weaken and fracture bones. Unfortunately for the zooarchaeologist, the burial of bone is seldom a rapid process and may take years or even generations to occur, which can be evaluated through bone weathering. Also, a buried assemblage can be exhumed, thereby reexposing the bones to surface processes that deteriorate them.

With the final deposition of the bones into an ancient Near Eastern urban complex, they become incorporated into the archaeological assemblage. This assemblage, at the time of deposition, constitutes all the bones that a zooarchaeologist has the potential to recover. In a perfect situation, or better described as wishful thinking, each bone that becomes part of the archaeological assemblage will be recovered during an excavation. This, however, is seldom the case. Nevertheless, considering all the processes described above, the archaeological assemblage is only a minor reflection of the herd assemblage. Distortions generated by the processes affecting each faunal assemblage will have deteriorated, disintegrated, left out, or culturally affected the specific species, carcass parts, and bone fragments within the archaeological assemblage. Based on the assessment of these processes more robust interpretations can be made when analyzing faunal assemblages.

Harvest Profiles

Domestic animals are kept and raised for a variety of uses that can vary from herd to herd and between communities. In pastoral systems, animals serve to provide products to the community that can be labeled as primary or secondary. A pastoralist's decision to cull or sell animals is a major concern for both herders and consumers (Perevelotski 1986). Generally, animals are used as a food source; therefore the meat can be considered a primary resource. Secondary products such as dairy, wool, labor etc. are also known as by-products. Many of the products they provide, such as labor (beast of burden or draft), milk and other dairy products, dung for fuel, and wool, are collected or used based on a routine schedule. Therefore, it is useful to keep certain animals within a herd and utilize them for these secondary products. However, the final products domesticated animals can provide, such as meat, hides, and fibers, are collected after they are slaughtered, and are only collected once. A basic understanding of the pastoral goals can provide insight into the production, organization, and distribution systems that sustained ancient Near Eastern sites. One way of inferring the pastoral focus is with harvest profiles distributed in the faunal remains.

Production goals of herders in the historical periods can be reflected in the animal bone samples recovered from archaeological sites. For example, a high percentage of young animals within a sample of sheep or goat bones may suggest a reliance on dairy production (Wapnish and Hesse 2003). By contrast, a high percentage of older animals may suggest a specialization focused on fiber. In order to discern kill-off or harvest patterns, these remains can be compared with results presented by Payne (1973:281) and

Silver (1969) (**Table 5.2**). The age at which animals are slaughtered depends on a host of factors dictated by producers, market demands, or consumption patterns (Watson 1978). First, the relative value placed on different products plays a key role in culling patterns. Payne (1973) points out that animals culled at an early age are used for their meat products while older animals are used for by-products, such as milk, wool, labor, and dung. In a dairy producing economies, more females will be maintained into old age, while many young males will be selected for slaughter.

Decisions about which animals to slaughter by type and age are dictated by the demands placed upon pastoralists. These demands can resonate from markets or political pressure. As a viable factor, harvest profiles can provide information to assist in detecting the exchange of animals between producers and consumers. Using bone and dental elements to identify kill-off patterns can provide insight into the management practices and the relationships between producers and consumers (Zeder 1991:40; Hesse and Wapnish 1991:27). Harvest profiles for the Tell Madaba faunal sample were calculated using epiphyseal fusion based on methods presented by Silver (1969). Harvest profiles based on dental wear patterns follow methods presented by Payne (1973) and Grant's (1982) guide to tooth wear in ungulates.

Table 5-2. Ossification centers and age of fusion				
Bone	**Ossification Center**	**Domestic Animal Fusion Ages**		
		Cattle	**Sheep/Goats**	**Pigs**
Humerus	Proximal	3.5-4.0 Years	3.0-3.5 years	3.5 years
	Distal	15-18 months	10 months	1 year
Radius	Proximal	15-18 months	10 months	1 year
	Distal	3.5 years	3 years	3.5 years
Ulna	Proximal	3.5 years	2.5 years	3-3.5 years
	Distal	Before 2 months	2.5 years	3-3.5 years
Metacarpus	Proximal	Before birth	Before birth	Before Birth
	Distal	15-18 months	2.0-2.5 years	18-24 months
1st Phalanx	Proximal	13-15 months	Before birth	7 months
	Distal	Before birth	1.5 years	Before Birth
2nd Phalanx	Proximal	9-12 months	Before birth	1 year
	Distal	Before birth	13-16 months	Before Birth
Femur	Proximal	3.0-3.5 years	2.5-3.0 years	3.5 years
	Distal	3.0-3.5 years	3.0-3.5 years	3.5 years
Tibia	Proximal	3.0-3.5 years	3.0-3.5 years	3.5 years
	Distal	20-24 months	2.0-2.5 years	2 years
Fibula	Distal	3 years	Separate bone	2.5 years
	Proximal	1-3 months	Separate bone	Before Birth

Source: Silver 1973

Bones and teeth of certain animals provide clues to the age and season during which the animal was killed (Hillson 1986; Grigson 1978, 1982). At certain ages the long bones of animals fuse (Grigson 1982; Grant 1975; 1982, Klein et al. 1981, 1983; Noddle 1974; Silver 1969). For example, an un-used distal end of a caprine humerus recovered at an archaeological site suggests that the animal was slaughtered before it was one year old. Also, at certain ages animals lose deciduous teeth and permanent teeth erupt. The rate at which teeth wear with use over time also is known for some animals, as is the peak birth months (Payne 1973).

Zooarchaeologists use both epiphyseal fusion and dental wear patterns when analyzing bones to calculate the age, and in some cases, the season in which an animal

was killed (Silver 1969; Payne 1973). With an adequate sample, a harvest profile of the archaeological assemblage mirroring slaughter patterns can be discerned. A wide range of inferences and conclusions can be drawn from harvest profiles about the relationship of humans to the animals they utilized-both domestic and wild (Hesse and Wapnish 1985).

Age distributions of animal mortality that are visible in zooarchaeological materials can be an indication of the production goals of pastoralists and market demands of settled communities (Cribb 1994; Grant 1975, 1982; Payne 1973; Zeder 1991; Wapnish and Hesse 1988, 1991). To make determinations about the age distributions of animals in Near Eastern bone samples, two methods are generally applied: fusion stages of long bones, and dental wear patterns on mandibular teeth.

Determining age at death using epiphyseal fusion stages follows methods provided by Silver (1969) and Grant (1975, 1982). Those methods are based upon the degree of diaphysis-epiphyseal fusion in the long bones of domestic animals. Particular long bones in mammals fuse by certain ages, and provide a series of age ranges for each particular fused or unfused bone. Long bone fusion stages can be used to determine the age of most of the domestic animals in question at Tell Madaba, including sheep, goats, cows, and pigs. Silver (1969) designates the boundary between "juveniles" and "adults" as two years for caprines, two and a half years for cattle, and two years for pigs. Some limitations are imposed because many animals live past the age at which the last bone fuses. Also, the fragile nature of unfused bones can create a problem due to differential preservation. Because the use of teeth to estimate the age of cattle is unreliable, the research presented in this dissertation used epiphyseal fusion stages to provide accurate

harvest profiles for cattle.

Another method often used to determine the age of animals is Payne's (1973) analysis that provides a series of age ranges based on tooth-wear stages. This method is applied only to the mandibular teeth and is based on the argument that the teeth of different animals will erupt, are replaced, and wear at a particular rate for each species (Payne 1973). The older the animal in question is at time of death, the more wear will be expected on the teeth. The teeth will be placed in different age groups that are defined by the patterns of tooth wear. From these age groups, a mortality profile of the sample can be generated. Dental wear patterns can be used to determine the age of sheep and goats, but is not as effective for cattle, pigs or wild game.

Urban Centers and their Effects on the Distribution of Animal Products

Urban centers contain a number of institutions and systems that significantly affect the way products are distributed (Schwartz and Falconer 1994; Falconer 1995). They are made up of a web of differentiated social classes that can include kin, ethnic, and economic groups. These groups can be spread across different segments of the city, and influenced by social, economic, political, and religious institutions. These different segments can affect how animal products are spatially patterned throughout the site (Wapnish and Hesse 1991:9-11). This spatial patterning will generate sub-samples within the faunal material relative to specific social and economic locations. Based on the history of Tell Madaba, the long urban tradition spanning numerous periods has significantly affected the faunal assemblages. Understanding some of these urban systems and process will aid in interpreting the faunal samples.

As urban centers and cities grow, many aspects of society will follow along a trajectory of complexity. Economic, political, social, and religious systems can all be affected by growing urban complexity. The faunal assemblages recovered from tell sites in the Near East can provide information about these systems and urban complexity. Wapnish and Hesse (1991) and Zeder (1991) have suggested that different sectors inside complex urban sites will affect the patterning of faunal material within the archaeological record.

Differential access to foods within different sectors of the city will generate variation in species proportions, harvest profiles, and carcass part distributions in different parts of the site (Hesse 1984 and 2001; Wapnish and Hesse 1991). In other words, the distribution of high and low value food items can vary based on social and economic status. Hesse and Wapnish (1991:23) have demonstrated that more sheep than goats will be maintained by pastoralists when animal production systems are tied to ancient urban market complexes. Khazanov (1983:23) has also stated that Iranian nomads maintaining their flocks near markets will keep more sheep than goats due to the market demands for sheep, and nomads farther away from the markets will maintain more goats because they provide more milk and are easier to maintain.

According to Zeder (1991:38) and Redding (1981:163), in terms of domestic livestock associated with ancient Near Eastern urban indirect distribution systems, sheep are more common than goats, while both sheep and goats are more common than cattle and pigs. In contrast, in an direct distribution system, goats should be more highly valued over sheep (Zeder 1991:37; Redding 1981:79-80). Sheep are valued for their wool in

addition to providing more meat than goats (Redding 1981:103). Market demands for sheep often conflict with producer's goals to maintain goats and cattle.

The age at which animals are slaughtered is also a key indicator of economic and social situations. Sections of a society that have greater access to market systems will generate higher proportions of discard from "Market Age" animals. This is the age of an animal at which the growth rate is on the verge of decline (Grantham 1992:140). That age coincides with adolescence, at which point the investment in food is no longer cost effective because the animal does not gain significant weight. In other words, it is more costly to continue raising the animal to feed it. This is a direct result of the relationship between the consumer's desires and the producer's interest (Wapnish and Hesse (1991:23).

The final effect on differential access to animals and animal products will be on carcass part distributions. One of the significant characteristics of an urbanized community that affects differential access is the increase in separation between the production, slaughtering, butchering, preparation, and consumption of animal products. Carcass parts will vary in elite living areas and public buildings compared to the more common domestic areas. Certain segments of the society are not expected to engage in the production of direct procurement of meat. In these instances, only certain bones should be encountered; selectivity of animal parts and evidence of butchery should be seen in the faunal assemblage. In those areas of a site where occupants had more access to whole animals, slaughter refuse, or offal, should be more common.

Near Eastern Animal Production, Distribution, Consumption, and Discard Systems

Animal bones are a significant part of Near Eastern archaeological contexts, and even more so within the ancient economic systems of the historic periods. Second only to ceramic sherds, animal bones provide complementary and substantial information for interpreting complex social and cultural structure. Near Eastern faunal assemblages can be divided into many different groups based on chronology and complexity. The research presented here focused on a faunal assemblage produced by complex societies involved in domestic animal husbandry and the exchange of animals and their by-products over space and time.

Many archaeologists have briefly described the exchange of domestic animals and by-products in the Near East (e.g., Hesse and Wapnish 2001; Wapnish 1993, 1995, 1996; Lev-Tov and McGeough 2007). These previous studies provide enough detail to allow for basic descriptions of ancient pastoral production and exchange systems. There are also a few ethnoarchaeological and ethnographical studies (see Postgate 1975, Zeder 1994, Grantham 1992, Stein 1992) that provide complementary interpretations.

Zeder's (1991) work on ancient city and urban organization and their effects on animal production systems included a detailed study for interpreting past animal production systems associated with the later historical periods. Her work, along with other research, has allowed for more interpretive work on village, city, and market exchange systems sustaining large urban sites throughout the Near East (Garfinkel et al. 2005; Bar-Yosef and Mayer 2005; Greenfield 2004; Horowitz 2001, 2002, 2003; Horowitz and Milevski 2001; Hesse 1984; Hesse and Wapnish 2001; Stein 1992,

1988;Wapnish and Hesse 1988, 1991; Zeder 1991; LaBianca 1990; Redding 1991; Cribb 1984, 1985, 1987; Uerpmann 1987; Cole 1975; Rosen 1986).

To formulate models for past Near Eastern animal production systems, it is crucial to gain an understanding of the societies that created the faunal assemblages. The many ways that bones get into tells involve a series of complex activities, beginning with herds and ending with the archaeological assemblage. These complexities are amplified with the development and continuity of Near Eastern urban complexes. Urban communities serve to increase the separation between slaughtering, butchering, and cooking. Gaining an understanding of the animal production system that supported these systems can be ascertained from the analysis of faunal assemblages recovered from archaeological sites.

Given the strong relationship between animal products and various elements of a society, significant changes in one sector of a society such as economic, cultural, sociopolitical, religious and ethnic sectors, can and should result in detectable changes within animal production, distribution, consumption and discard systems that sustained a settlement (Rossel 2007, 2007; Kansa 2004; Kansa et al. 2006; Lupo 2007; Bar-Yosef and Mayer 2005; Greenfield 2004; Horowitz 1987, 2001, 2002; Horowitz and Milevski 2001; Byrd 1992; Zeder 1991; Crabtree 1990; Hesse and Wapnish 1985). These changes can be seen in patterns in the archaeological assemblage and can be a direct reflection of human adaptation.

Information imparted from faunal distribution patterns can reveal distinctive patterns of behavior associated with various forms of herding strategies practiced

throughout different periods (Buitenhuis 1983, 1990; Clutton-Brock 1989; Davis 2000; Horwitz and Tchernov 1989; Payne 1973; Redding 1984; Tchernov and Horwitz 1990). The analysis of faunal remains should enable interpretation of adaptive strategies employed by the occupants of Tell Madaba over time and space.

A distinction must be made between producers and the consumers in the ancient community (Wapnish and Hesse 1991). The basic mode of animal exchange systems from ancient Near Eastern sites involves three broad groups: producer, distributors, and consumers. These sectors can further be divided into a multitude of segments along various lines of the exchange system. Specifically, pastoralists herd, butchers slaughter, markets distribute, and people consume and then discard.

Multi-level camps, villages, and urban centers played a role in the cultural landscape as a direct result of the advent of urbanization in the Near East (Wapnish and Hesse 1991; Planhol 1972; Kolars 1967; Gulick 1983). Guilick (1983) and Kolars (1967) provided classifications within rural and urban contexts including two broad groupings with several categories. These classifications consist of urban-directed villages and rural directed villages. Within urban-directed villages there will be market-seeking demands that will affect herd size and "cash crops." Also these sites will have a few members that benefit from the sale of goods and products. Rural-directed villages produce no surplus, and some of the community will be involved in outside labor activities (Wapnish and Hesse 1991).

The basic elements of animal production systems that sustained ancient communities in the Near East appear very simple. Animals were produced, slaughtered,

butchered, distributed, consumed, and finally discarded. These ancient systems involved a limited range of livestock, including mostly sheep, goats, cattle, horse/donkey, and pigs. Occasionally, a small amount of wild game can be detectable at urban tell sites, but their numbers are usually insignificant except under certain circumstances, such as the implementation of tribute by ruling states (Wapnish 1996:291). Since skeletal elements are discarded along the trajectory between the herd and the discard assemblage, the disbursement patterns of animal bones become even more distorted and can be biased toward certain elements or species in different parts of the site. These disbursement patterns are controlled by a complex web of environmental, economic, political, religious, and social situations that significantly create the archaeological assemblage (Redding 1991, Wapnish and Hesse 1988, Zeder 1991, Grantham 1992).

The faunal collection from Tell Madaba covers a broad span of time, assigned to several occupational periods and affected by the large-scale urbanization of the region. During these periods the region was engulfed in various levels of stability. The region was characterized by periods of stability interspersed with devastating conflicts, with kingdoms and city-states gaining and losing control through time. Tell Madaba itself witnessed periods of significant urban growth and periods of abandonment and ruralization. As urbanization began to increase in the Bronze Age economic systems became more complex and animal production systems became more segmented and segregated. Differential segments of animal production systems developed between the lines of production and consumption (Wapnish and Hesse 1988, 1991; Zeder 1991). This affected the animal production system in a multitude of ways. Although it is assumed, the

range of species found in these types of production systems may become limited in an urbanized society, the path an animal takes from the herd to the discard assemblage becomes extremely complex.

There are several hypotheses and models presented in the literature that are relevant to the study of animal production and consumption at Near Eastern urban and rural sites (see Redding 1991; Wapnish and Hesse 1988, 1991, 2001; Rosen 1993; Grantham 1992; Griffith 2001; Lev Tov 2001, 2003). These models are applicable to those faunal assemblages that contain domestic stock and rely on complex urban-rural animal production and distribution systems. Several of these are discussed below.

Domestic animals were an integral part of ancient Near Eastern economic systems. Viewed from a zooarchaeological perspective the major cultural-historical question here becomes: what was the nature of the distribution, preparation, and consumption of animal products? Zooarchaeologists have primarily focused on a limited number of variables when reconstructing past animal production systems of the Near East: relative abundance of the taxa, harvest profiles or mortality rates, and spatial distribution of bones (Hesse and Wapnish 2001; Grantham 1992; Wapnish and Hesse 1991; Zeder 1991; Redding 1991; Cribb 1984; Payne 1973).

Redding (1991) demonstrated that the perception of risk can be interpreted from ratios of sheep to goats and sheep/goat to cattle maintained by pastoralists. Age curves generated by Payne (1973) are tied to three main production goals of pastoralists: dairy, meat, and fiber products. In addition, Cribb (1984, 1985, and 1987) used computer simulations to illustrate how herd growth rates affect these models. LaBianca's (1990)

Food Systems theory serves to investigate social organization in the southern Levant. A food system centers around specific activities associated with procurement, processing, distribution, preparation, consumption and disposal of food remains (LaBianca 1990: 9). Social organization and ecological and political systems significantly influence a Food System. According to Hesse and Wapnish (2001) it is not a question of which model to use, it is more a question of timing, i.e. when to use which model. Since complex urban societies generate an abundance of issues that surround animals and their products, models that illustrate animal production systems need to be examined.

Hesse and Wapnish (2001:254) suggest that the exploitation of animals occurs along a differentiated axis consisting of temporal, spatial, and social lines (**Figure 5.1**). A theme also examined by Grantham (1992) and Griffith (2001). Hesse and Wapnish (2001) identified three segments of communities that support these ancient systems; cities, villages, and nomadic groups. In certain instances mobile pastoralist move their herds seasonally to take advantage of water and food for their livestock. In other circumstances a more village-based pastoralism occurs where herdsmen have a slightly more limited range of movement and return to their home base or camps routinely. Additionally, agriculture and animal herding can be combined within an agro-pastoralism economic system. It becomes the task of the zooarchaeologist to determine the level of specialization in the animal production system. This in turn can be presented in a Near Eastern historical perspective.

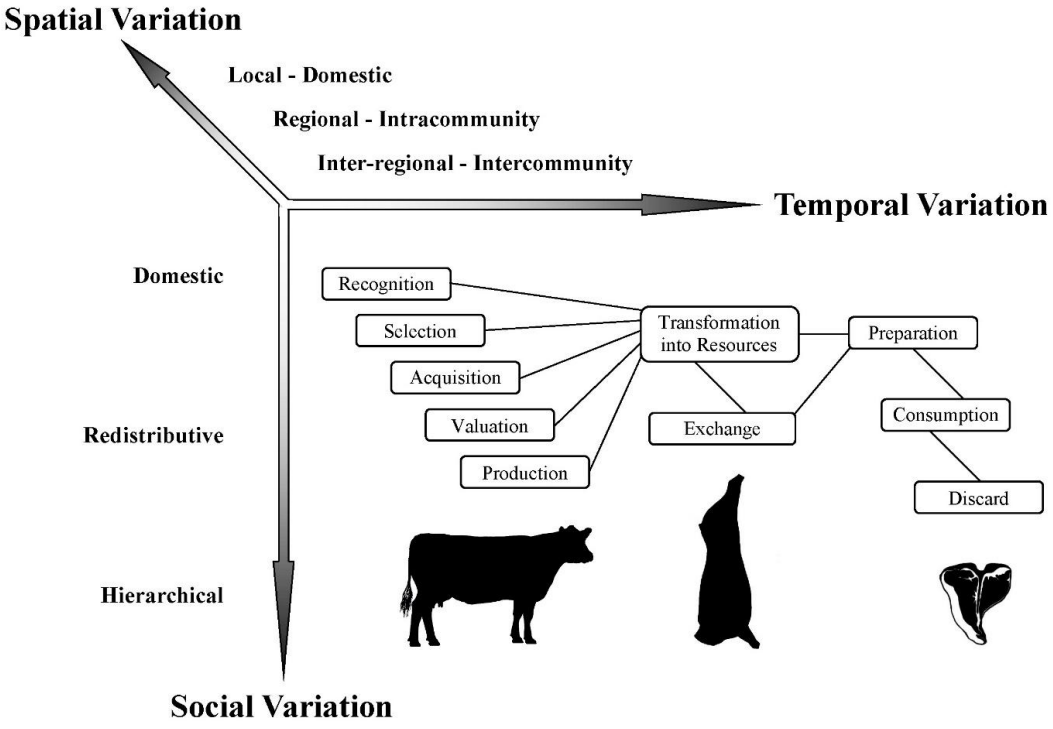

Figure 5.1. Schematic showing the lines of exploitation in Near Eastern animal production systems (Hesse and Wapnish 2001)

Animal production is a process of reduction: reducing and separating animal parts sometimes over large sites or regions (Hesse and Wapnish 1985). Within animal husbandry, animals are raised, slaughtered, butchered, and distributed. At this point various parts of the carcass are cooked or tanned, and occasionally formed into tools. When the utilization of the animal has been exhausted the end products, in this case bones, are discarded. In complex urban distribution systems various parts of the animal can become widely distributed across a large area. Whole animals, or carcasses, are not usually distributed to the same household or complex. The system dictating how and where animal parts are distributed and discarded can be controlled by different groups or

segments of society. Many factors affect the outcome, such as available species, dietary preferences, and social and economic segregation. The task of the zooarchaeologist is to deduce as much detail of the production-distribution-consumption system in place during a given period. This task has proven more difficult than one might think.

Ancient textual and ethnographic studies suggests that raising livestock, consuming meat and dairy products, using beasts of burden for labor, generating fiber, tanning and using hides, and exchanging animal products have been a part of Near Eastern economic activities from ancient times up to the present day. Over time, importance placed on certain animals may have changed and a small number of livestock animals may have been introduced from outside. Much of the textual information is only a partial description of these systems that supported the large urban sites (Hesse and Wapnish 2001; Wapnish 1993, 1996).

When constructing hypotheses and models to describe ancient animal economies, three main variables have been stressed: relative abundance of taxa, mortality curves for each species, and spatial distribution of skeletal elements (Wapnish and Hesse 1991; Zeder 1991). One major focus of zooarchaeological research has been to decipher the production goals of pastoralists. Redding (1991), Hesse (1995) and Rosen (1996) have shown that sheep to goat and sheep/goat to cattle ratios are controlled by the perception of risk and the agricultural system in the vicinity of the site. They also stressed that the local environment influenced these decisions. One main conclusion is that with the intensification of agriculture near a settlement there will be an increase in cattle, which

are used primarily as draft animals. Basically the demands, or lack thereof, on herders influence their choices concerning herd management practices.

Carcass parts also contain certain valued aspects (Lyman 1984; Binford 1981; Hellwing and Gophna 1984). Lyman (1984) offers the concept: "differential transportation of food" which follows Binford's (1978) "food utility indexes," also discussed by Metcalfe and Jones (1988). Each places a value on the different parts of the animal as a food source. Carcass parts that have a high utility level are more in demand and are thus more likely to be found in the remains near the settlement. In contrast to the high utility mode, carcass parts that have a low utility mode are less likely to find their way into the distribution of carcass parts at the settlement. Utility indices (Lyman 1994:225) can be used to predict the bone remains associated with each mode.

Hellwing and Gophna (1984:48-59) offer an approach based on the degree of complexity within a sociocultural group that influences animals, and the transformation from pasture to food is visible in the spatial distribution of carcass parts across a site. Zeder (1991) has expanded this model in her influential publication *Feeding Cities.* Grantham (1992) argued that carcass part distributions are a direct result of cultural values and are contained within the realm of cuisine.

As described earlier, animal exploitation in ancient Near Eastern sites is guided along three major axes – temporal, spatial, and social (Hesse and Wapnish 2001:254). The temporal axis expresses that an animal must first be recognized as a useful resource. Once an animal has been recognized the process of acquiring it for production occurs and may involve hunting or herding. This process can narrow the list of various animals that a

group exploits. Hence, placing value on each species recognized as a resource. At the end of the cycle for secondary products individual animals may become part of the slaughtered assemblage. At this point animals are selected for slaughter, butchered, consumed, and skeletal parts eventually discarded (Hesse and Wapnish 2001). This is an intertwined system that can disarticulate skeletons and redistribute animal bones over vast areas. Environmental, economic and social circumstances affect the rate and degree these processes occur. The relationship between producers and consumers significantly affect this system. Production strategies and consumer needs and wants would dictate the specific animal species, ages, and cuts of meat reflected in the faunal assemblage.

Once animals move through the temporal axis they will eventually be slaughtered and enter the spatial axis (Hesse and Wapnish 2001:254). Here, production, exchange and consumption will be differentiated into various sectors of the society. This can be localized where there is local production for local consumption (Zeder 1991; Wapnish and Hesse 1988). In other words, animals are herded in the vicinity where they are consumed. To simplify, a household may produce for their own consumption, or exchange with neighbors nearby.

Production systems also become very complex and span over long distances both spatially and socially. In this situation the involvement of specialists can become a complex part of the production and distribution system. Individuals or groups involved with herding, slaughtering, butchering, and cooking often become differentiated and separate. However, in some cases these groups can merge. For example, herding may be maintained by the individual or group that slaughters, butchers, and distributes the animal

parts. These groups are often dispersed across larger areas within the community or even territory. Regardless, each sector has a variety of economic, ideological, and social motivations guiding the decision making process (Wapnish and Hesse 1988, 2001; Zeder 1991; Grantham 1992; Griffith 2001).

The social axis operates in a unique realm that can dictate patterns of distribution of animal parts. Social and political relationships can be very complex and become hierarchical, heterachical, or even egalitarian. Kin-based groups may require sharing or obligatory tribute, controlling states may dictate tribute taken from smaller sites, and even market demands may dictate what animals or parts are exchanged at certain localities. The dynamic realm of the social axis can function as a controlling entity that prohibits herdsmen from raising animals they desire. Instead, they will have to yield to social, economic, political, or market pressures (Wapnish and Hesse 1988; Zeder 1991).

Over the past two decades, culinary or cuisine models have gained popularity within research perspectives of Near Eastern zooarchaeology (Wapnish and Hesse 2001; Grantham 1992; Goody 1982). These models incorporate cultural aspects of animals and present them as processes that tie producers, here known as pastoralist, butchers, distributors, consumers and those discarding and cleaning as participants within differentiated systems (Hesse and Wapnish 1991). This associates the bones discarded and recovered at archaeological sites to this system which Hesse and Wapnish (1991) label as "feed-forward, feed-back." Prior to this, most theoretical models dealt specifically with the producers and their goals for herding and producing animals. The

decisions of which animals to cull and when are based on a series of goals assigned to both the producers and the consumers. These are directly influenced by consumers' desires or political control, not just herd security or maintenance. The culinary approach emphasizes each segment of the production-distribution-consumption system as an active participant in the decision-making processes.

Macro and Micro Level Models

Human adaptation has been at the forefront of archaeological research for more than a century. Faunal analysis can provide a wealth of cultural and environmental interpretive data for understanding human adaptation. Distribution patterns visible within the faunal assemblage can help discern adaptive strategies employed by ancient communities within production and economic systems. Zooarchaeological models illustrating adaptive strategies in the semi-arid highlands of Jordan must include both local and regional perspectives in combination with the realm of sociocultural and environmental questions. The research presented in this dissertation analyzes faunal material at two specific research levels to provide interpretive information: Micro and Macro.

Micro-level investigations can elucidate cultural and natural features within the confines of the site in general – e.g. the distribution of activities within a particular community, based on zooarchaeological interpretation (Hellwing and Gophna 1984; Grantham 1992; Zeder 1991; Hesse and Wapnish 1985, 2001; Griffith 2001; Wapnish and Hesse 1988). These methods also confront the taphonomic questions which are raised by the wide range of site formation processes and their effects on the archaeological

record (Hassan 1978; Hesse and Wapnish 1985; Schiffer 1987; Hesse and Rosen 1988; Grantham 1992; Lyman 1994a).

In contrast, macro-level investigations usually center on large scale components of the regional setting of an archaeological site – e.g., the characterization of the local environment (Hassan 1978; Hesse and Wapnish 1985; Rosen 1986; Schiffer 1987; Hesse and Rosen 1988; Grantham 1992; Lyman 1994) and the pattern of resource exploitation, along with the economic integration of particular communities into regional settlement systems (Zeder 1991; Hesse and Wapnish 1988 and 1991; Griffith 2001). Macro-level analysis functions as a study of large scale regional environmental and social processes that alter and contribute to the site, while micro-level analysis provides insight into small scale spatial implications of these two processes limited within the site itself and establishes the context within which the macro-level interpretations are drawn (Griffith 2001).

Each level of analysis has the potential to elucidate cultural features within the broader scheme of human adaptive strategies. Macro-level models serve to place the site in question within a regional context (Griffith 2001). In contrast, Micro-level models provide internal insight into a site's spatial and temporal variability. Each analytical level viewed separately, and in concert, can provide information about the adaptive strategies on both local and regional scales.

Macro-Level Zooarchaeology Models and Predictions for Tell Madaba

Zooarchaeological models have become increasingly structured along both regional and local research questions. Culture-historical aspects of ancient communities

can be evaluated in site specific and regional interpretations. Within the broader perspective of macro- research, the major culture-historical question to be asked is: how does the site fit into the larger regional system? This includes politics, society, culture, economics, and religion. Since the material analyzed in this research is zoological, the question can be recast as: What was the nature of the pastoral production, distribution, and consumption system that supported Tell Madaba and how did it change over time?

In order to evaluate this broad question several aspects of the animal production system at Tell Madaba must be evaluated. Major shifts in the animal production system from the Bronze Age through the Ottoman period can be reflective of the nature of adaptive strategies. To answer these questions from an archaeological perspective the main animal foods exploited by the inhabitants and in what proportions they utilized the various species must be discerned. Plus, evidence that the community exported or imported animal products has to be evaluated. Finally, evidence for differences within the community with access to animal products can provide information for social differences at the site. Answers to these questions can be reflective of adaptive strategies used by the occupants over a long temporal span. When using zooarchaeological data in concert with other archaeological evidence , such as technology, architecture, etc., a broader understanding of human adaptation will emerge.

In an effort to evaluate the animal economic system that supported Tell Madaba over time and space several models will need to be examined to see which, if any, are congruent with the various bone patterns generated from the samples. Within any of these three models, different areas of the site can produce different patterns of faunal remains

depending upon the varying degrees of access to the different carcass parts that the inhabitants of Tell Madaba may have had. Each of these models can be associated with certain expectations for the zooarchaeological record which are outlined below.

If the pastoral economy of ancient Tell Madaba was organized locally to meet local levels of demand - domestic production for domestic needs – then several aspects of the bone statistics should reflect this. If herdsmen were producing for their own households, there would be a wide range of domestic stock within discard assemblages. Emphasis would have been placed on those species that are close herded. For example, goats and cattle would dominate over sheep (Zeder 1991:38). In this type of system pigs can become an important source of meat. In areas where agriculture becomes intensified there tends to be an increase in the ratio of cattle to sheep/goats because of the need for large animals to pull the plows (Redding 1993:86).

If Tell Madaba functioned as a regional or local center for the delivery and exchange of animal products, the pulling of stock and pastoral products from a surrounding array of smaller communities, the faunal assemblage should reflect this. If Tell Madaba was being supplied directly by tethered producers, there should be a decrease in the diversity of species (Zeder 1991:87). Sheep would become more common because meat production would be a specialization of nomadic herdsmen located outside of the city. Pigs will decline in significance as an additional byproduct of specialized pastoral production. Wild game should all but disappear from the discard assemblage. Most of the bones recovered in the archaeological assemblage should be characterized by the typical livestock in Near Eastern animal production systems. This would also be

biased towards those animals that are most desired or demanded by the market system (**Table 5.3**).

Table 5-3. Animal expectations for each model			
Fauna	**Individual Production**	**Regional Center**	**Tethered Site**
Pigs	High	Low	Med
Sheep	High	High	Low
Goats	High	Med/High	Low
Cattle	Low	Low	High
Wild Herbivores	High	Low	High

Within the broader scheme of Near Eastern urban complexes that were part of larger city-states, regional centers would dictate economic principles and may serve to force the delivery of animal products either as tribute or to supply markets (Wapnish 1996, Zeder 1991). Wapnish (1996) has shown that high value animals raised at certain locations would be less available to the local inhabitants because the ruling center dictated where those animals were distributed. Therefore, we can test the faunal statistics at Tell Madaba to see if it was controlled by a larger center in the region. If the pastoral economy of Tell Madaba was tethered to a larger center providing animal products in way of tribute or for market supply the abundance of species would be dis-proportionately represented. High value animals should decrease because they would be extracted for tribute. The high value animals would have been transported to larger controlling urban centers, or provided to armies and government administrative centers (Wapnish 1996; Wapnish and Hesse 1988). Since sheep are considered higher valued animals within Near Eastern urban market systems, a noticeable increase in goats and the decrease in sheep would be visible in the faunal sample at the point of origin. With limited access to higher valued animals, many of the occupants would supplement their

diets through hunting, therefore, more wild game is expected in the sample (Wapnish and Hesse 1991).

If the occupants of Tell Madaba had different degrees of access to animal products there will be differences in species abundance in different households within the city. This would be reflected in uneven spatial patterns of species due to the differential access to animal products that the various segments of the society would be allotted (Wapnish and Hesse 1991:27).

Harvest Profiles

One way of determining how animals were being utilized is through the analysis of the ages at which animals were slaughtered. The act of slaughtering is very important within pastoral management and age distributions can be associated with different management goals (Hesse 1986). A fundamental choice made by herdsmen is the decision to slaughter. The choices of when to select and which animals to use are determined by a host of complex factors. The result is an age distribution of animal mortality visible in archaeological materials which can be linked to the type of social and economic system utilized by the settlement (Cribb 1984, Payne 1973). The age curve expectation for each of the models is outlined in Table 5.4 and discussed below.

Table 5-4. Age range expectation for each model

Fauna	**Individual Production**	**Regional Center**	**Tethered Site**
Pigs	4-6 Months	6Months	Over 3 Years
Sheep	6Months-8-10Years	2-3Years	Over 3 Years
Goats	6Months-8-10Years	2-3Years	Over 3 Years
Cattle	6Months-8-10Years	4Years	Over 4 Years

If the pastoral economy of Tell Madaba was organized locally the sample would show a wide range of ages for the animals, generally 6 months to 8-10 years and older, because the consumers would have access to the entire herd (Zeder 1991:40). Pastoral goals would be based on herd management for by-products more so than for high valued animals and ages based on consumer demands. Therefore, age ranges within this system would reflect the slaughtering of less specific age distributions.

If Tell Madaba developed into a regional or local center dictating what animals were distributed within the site and to other smaller locations there would be a narrower range of ages and most of the animals would be of market age (one to three years) (Zeder 1991:40). With this scenario, the inhabitants would draw the more valuable market age animals from groups outside of the city, but controlled by Tell Madaba. This particular type of system can be small or large scale. On a small scale, the site would serve to control small villages and hamlets nearby in the area. Primarily, it would fall into an urban-rural dichotomy. In certain circumstances, large sites in the Near East served to control vast regions of the area. If this is the case the site would function as a city-state controlling numerous sites, both small and large.

If Tell Madaba was tethered to a larger center there would be an increase in the diversity of ages outside of the market age. This would be in part because the inhabitants of Tell Madaba would be forced to use the more valuable animals for tribute or to supply markets (Wapnish 1996:291). Older animals from the higher valued animals should be expected. While, the age ranges of the lower value animals may continue to reflect market age animals.

If the inhabitants of Tell Madaba had different degrees of access to animal products there would be a spatial patterning of the ages of the animals, as with species distribution. Table 5.4 lists the age expectations for each model. Those segments of the society that depended more on markets for their food would generate less diversity in the age range of the animals since most of them would be of market age (Wapnish and Hesse 1991:27). Those segments of society that did not have access to the market would generate more diversity in the age range for the animals.

Micro-level Models

Different carcass parts can be discarded at various points on the line between production and consumption depending on what type of production system the location utilized. These distribution patterns can form into sub-samples within the faunal remains. There will be two axes, conceptually at right angles to each other, along which this will occur: 1) the trajectory from slaughter to discard; and 2) the differences between consuming households (Griffith 2001). A number of authors have offered suggestions concerning these patterns of distribution and are discussed below.

The use of various parts of the animal as food can be divided into different categories. Lyman (1984, 1994a) offers the concept; "differential transportation of food." He suggests two modes; high utility and low utility. Each mode places a value on the different parts of the animal as a food source. Carcass parts that have a high utility level are more in demand and are thus more likely to be found in the remains found near the settlement. In contrast to the high utility mode, the carcass parts that have a low utility mode are less likely to find their way into the distribution of carcass parts at the

settlement. Utility indices (Lyman 1994:225) can be used to hypothesize the bone remains associated with each mode.

Hellwing and Gophna (1984) offer a parallel approach. They classify the various parts of the animal as either slaughter offal or consumption offal. Slaughter offal (the carcass parts with low meat to bone ratios) includes those parts of the carcass that are considered primary refuse; skull and foot bones. Slaughter offal is discarded relatively early in the butchering process. Consumption offal (the carcass parts with high meat to bone ratios) includes the parts that are considered to be secondary refuse; limb and trunk bones. Consumption offal is discarded during the later stages of consumption. Hellwing and Gophna (1984:51) state that the differences in the distribution of these two types of refuse may show differences in the economic structure of the population. In other words, the more complex that the production system is, then the more likely that slaughter and butcher offal will be deposited in different locations. Changes in the ratio of these two types of offal can be a measure of the specialization of the animal processing and consumption process.

Zeder (1991) has developed a similar model for the interpretation of carcass part distributions. This is a comparative model based on changes in carcass part and species distribution. She interprets differential access to animal products as being evidenced in the spatial variation of carcass part distributions. She also interprets the changes in carcass part distribution as evidence of increasing economic complexity. As a society shifts from a rural to a more urban configuration, distinct patterns will emerge in the carcass part distribution. This model has the potential to help discern whether or not the

inhabitants of the architectural units uncovered at Tell Madaba were being supplied directly or indirectly.

Grantham's (1992) cuisine model is based on household strategies of consumption and production and was derived ethnographically. This model will help to distinguish the different kinds of activity areas that are present based on the types of bone fragments uncovered. With the use of data obtained on the Druze, a traditional society located in the Golan Heights, Grantham (1992) established expectations for the skeletal remains associated with the different components of the culinary process. Slaughtering, food preparation, consumption, courtyards, and trash deposits were all found to have distinct discard patterns (Grantham 1992; and Hesse and Wapnish 1997:4). Grantham's expectations (1992:88-89) for each area are listed below:

1) Slaughter areas should be represented by a relatively higher proportion of phalanges and metapodials.

2) Food preparation areas should be represented by relatively higher percentages of bones that are removed before cooking (mainly long bones).

3) Consumption areas should be represented by relatively higher percentages of bones that are not removed from meat before serving and a relatively low density of bones per square unit (mainly ribs and vertebrae).

4) Courtyards should resemble indoor food preparation areas if food preparation activities took place there.

5) Trash deposits in the alleys could be variable in both proportions of carcass parts represented. Generally speaking, however, alley deposits are expected to represent all carcass parts more or less evenly due to the fact that in most cases there will be an accumulation of bones from multiple activities.

6) Trash deposits in pits or central dump areas should represent all carcass parts more or less evenly.

Grantham found that the distribution of species and carcass parts for the domestic areas differed from those found in the areas labeled non-domestic. For the non-domestic

units the density of bones per unit was found to be higher than that for the domestic units. Grantham (1992:119) suggests that this was caused from the intentional deposition of bones over time. He also associates large accumulations of bones as a possible indication of non-domestic use. The carcass part distribution for non-domestic units was found to be similar to areas labeled as food consumption areas, with the non-domestic areas exhibiting a higher density of bones per unit. He found that fewer limb bones were present in the non-domestic structures and that cattle and chicken bones were found at a higher rate, with a decrease in sheep/goat bones. However, when the sheep bones were compared with the goat bones, Grantham found that in the areas labeled as non-domestic sheep were more abundant, and in those areas labeled domestic goats were more common. The alleyways exhibited a sample that most likely represented a combination of each of the two areas. Grantham (1992:174) interprets this distribution of animal bones for the non-domestic units as indicating animal production and processing areas. It is predicted that large-scale changes in the abundance of taxa, harvest profiles, and carcass parts across space and time should be recognizable within the bone statistics generated.

CHAPTER 6
METHODOLOGY AND CONTEXT

The sample of bones analyzed in this dissertation consists of two parts. First, the sample of animal bones from the 1996 Field A excavations identified by Brian Hesse at the University of Alabama at Birmingham (Harrison et al. 2000). The second part consists of the animal bone samples excavated between 1998 and 2002 in Fields B and C and identified by myself under the direction of Brian Hesse. The amount of animal bones excavated from the three areas is extremely large consisting of approximately 56,810 bones (**Table 6.1**) with Field B producing 47,996 bones.

Table 6-1. Distribution of bones within each excavation field

FIELD	**Number**	**%**
FIELD A	4,159	7.30%
FIELD B	47,996	84.50%
FIELD C	4,655	8.20%
Total	**56,810**	**100.00%**

The Tell Madaba faunal assemblage was assessed using basic zooarchaeological research methods based primarily on identifications, analysis, and interpretations as described by Davis (1987), Hesse and Wapnish (1985), Klein and Cruz-Uribe (1984), and Reitz and Wing (2008). The data gathered from the Tell Madaba zooarchaeological samples include species identification, bone element identification, loci, relative dates, modifications, and size.

When reasonable, all bones were taxonomically identified beyond the level of class, and to the highest level of taxonomic identification. Species morphology and identification in sheep and goats were assessed based on the published works of Boesnneck (1969, 1970), Helmer and Rocheteau (1994) and Schmid (1972) in

combination with an on-site and laboratory comparative collection. A distinction between sheep and goats was always attempted; however, when a clear distinction could not be made, the element was catalogued as sheep/goat. However the difficulties in distinguishing between bones of sheep and goats have been well documented (Boessneck 1969; Halstead and Collins 2002; Zeder 2006). In many cases specimens could not be identified to species but were distinguishable and categorized as small mammals (SM), medium mammals (MM), or large mammals (LM). SMs consist of rodent, hare, and rabbit sized animals. Although, in ancient Near Eastern Urban sites most all of the MMs consist of sheep and goats (Hesse et al. 2011), other animals present in the region include pig, deer, dog, two species of gazelle, ibex, hyena, and other wild MM species. LMs consist almost entirely of cattle, however, horse, donkey, camel, and onagers were present in the region.

Relative abundance of the main species can be estimated by various statistical measures. This research adhered to the guidelines of Hesse and Wapnish (1985) and the ratios were computed using three different statistical measures; Total Number of Fragments (TNF), Minimum Number of Individuals (MNI), and Relative Frequency (RF). Each of these measures of abundance makes slightly different assumptions about the nature of the sample, and collectively, they provide a robust estimate. Throughout the analysis most statistical measures are presented as a percentage for comparison purposes.

TNF is the total count of all bone fragments assigned to a particular taxon within a given sample. It tends to overestimate the abundance of animals that may have been less frequently utilized but are represented by a larger number of bone fragment

categories (Hesse and Wapnish 1985:112-115; Marshall and Pilgram 1993).

MNI is a measure of abundance calculated from the most frequent bone fragment category of a taxon within a sample. For example, if a sample is represented by 5 right distal humeri and one right proximal humeri the MNI is estimated to be five. In addition, fusion age stages were also assessed when determining MNI. This provides an estimate of the minimum number of individual animals it would require to produce the archaeological sample at hand. The major problem with this method is that it is very sensitive to how a collection is broken into subsamples on archaeological grounds before the MNI is calculated. It assumes maximal interdependence between the bones in a sample. Also, it is confounded in cases where whole carcasses are not being processed at the ancient cultural site being studied (Hesse and Wapnish 1985:113-114; Marshall and Pilgram 1993).

RF is calculated by dividing the total number of bone types representing a species into the total number of fragments within the different types. This results in an average MNI. It does not produce a measure of the actual number of individuals represented within the given sample (Hesse and Wapnish 1985: 115-116).

Another important method of examining a sample of bones is to examine what Hesse and Wapnish (1985: 95-96) refer to as the "archaeological animal: or how a taxon is actually represented in the sample by the relative proportion of skeletal elements. To accomplish this, bones from the main species were assigned to analytical categories and chi-square analysis was used to determine if any carcass parts were over or under represented. The categories chosen are the head, axial skeleton, forelimbs, hindlimbs, and

feet. The head category is made up of cranial fragments and teeth, including the mandible. The axial category includes all the vertebrae and ribs. Forelimbs contain the humerus, radius, ulna, and carpals. Hindlimbs contain the femur, tibia, fibula, astragali, calcanei, and tarsals. The feet contain the metapodials and all the phalanges.

The basic concept behind the archaeological animal is to determine if certain carcass parts are over or under represented. This divides the carcass into high meat and low meat to bone ratios. The hindlimbs, forelimbs, and axial skeletal parts are the more meaty portions while the head and feet are the less meaty parts. Hence, these sections of a carcass can be divided into slaughtered parts and butchered parts. The less meaty parts are typically considered slaughtered parts and less desired cuts of meat, while butchered parts contain the meatier portions of the carcass.

The majority of the material was recovered from a series of relatively dated loci based on ceramic analysis. A total of 49,486 bones was assigned to seven chronological time periods while 7,327 were from mixed or modern contexts (**Table 6.2**). Most of the material was collected from 1/4 inch hardware mesh screen. After the bones were recovered, they were sorted into a variety of anatomical categories using methods described by Schmid (1972). A distinction was made between fully-identifiable and less-identifiable bones. The less-identifiable category includes ribs, long bone shaft fragments, vertebrae, and unidentifiable bones. The fully-identifiable bones were then sorted into species, age, and element, including size, epiphyseal fusion, dental eruption, and modification. The bones were then cataloged in a field notebook, with drawings of certain specimens of interest. The bone samples analyzed were divided into various

Table 6.2. Distribution of bones within each occupational phase at Tell Madaba.		
Period	**Number**	**%**
EBA	1,616	3.30%
IRII	16,158	32.70%
LATE HELLENISTIC	5,880	11.90%
EARLY ROMAN/NABATAEAN	21,867	44.20%
BYZANTINE	311	0.60%
LATE BYZANTINE/EARLY ISLAMIC	3,558	7.20%
OTTOMAN	96	0.20%
Total	**49,486**	**100.00 %**

contextual deposits based on locus assignment where applicable. A total of 47,227 bones was assigned to distinct contexts (**Table 6.3**). The vast majority of bones recovered, approximately 45%, was associated with basic soil layers within the occupational phases. These loci were made up of general soil layers, sheetwash, packed soil, and top soil. Fill layers were the second most common context and made up approximately 14% of the sample. Surfaces, consisting of activity areas and floors, made up approximately 12% of the sample. All other contexts represent less than ten% of the sample.

The fully-identifiable bones were sorted into species, age, and element and measured where appropriate. Modifications, such as cutmarks, sawmarks, chopmarks, , and burning were recorded. All possible measurements were taken in the field, and conformed to the methods established by von den Driesch (1976). The bones were then cataloged in a field notebook, with drawings made of certain specimens of particular interest.

Table 6.3. Context of identified bones		
Context	**Number**	**%**
Soil Layer	21586	45.71%
Fill	6,588	13.95%
Surface	5,604	11.87%
Rock Tumble	2,469	5.23%
Trash Deposit	3,021	6.40%
Pit	2,049	4.34%
Occupational Debris	1307	2.77%
Collapse	1,104	2.34%
Wall	761	1.61%
Foundation Trench	517	1.09%
Rubble/Topsoil	379	0.80%
Mudbrick Detritus	376	0.80%
Stone Bin	305	0.65%
Disturbed Tesserae	258	0.55%
Stone Platform	219	0.46%
Silo	200	0.42%
Rock Fall	169	0.36%
Modern Fill	130	0.28%
Tabun	80	0.17%
Destruction Debris	43	0.09%
Ash Locus	38	0.08%
Balk	24	0.05%
Total	**47,227**	**100.00%**

Taphonomic Issues

Taphonomic processes significantly affect the preservation of animal bones discarded at ancient sites. An assessment of these processes was conducted to ascertain if the bones at Tell Madaba were being differentially preserved. This assessment was done using three categories of bone identification: scrap, long bone shaft fragments (LBSF), and identifiable. The most general identification of small bone fragments with no distinct

morphological features is the category of "scrap." Next are the shafts of long bones, which are typically identifiable only as SM, MM, or LM. Bones that can be assigned to a more specific anatomical category, other than scrap or shafts, are considered identifiable. These specimens can be assigned to some portion of the skeleton (e.g., head and teeth, vertebrae and rib cage, forelimb, hindlimb, or feet), and to a taxon more specific than animal or size categories.

Variations in the relative abundance of these three categories of bone finds—scrap, LBSF, and identifiable—provide a rough measure of the taphonomic pressure experienced by the sample due to post depositional processes such as trampling. The ratios between the identifiable bones, LBSF, and scrap for each time period were calculated to determine if any bias could be identified in recovery techniques or if differential preservation affected the sample (**Table 6.4**). Examination of these basic categories produced some contrasting results. A high percentage of scrap is present throughout most of the time periods, with the Early Roman, Late Hellenistic, and Late Byzantine yielding the largest abundance of scrap.

These high percentages of scrap may be in part due to the high number of pits excavated associated with those time periods. A similar result is seen when the frequencies are calculated for each of the three excavation areas (**Table 6.5**). Both Areas B and C contain higher percentages of scrap than identifiable bones. Area A contained a gradual breakdown between identifiable bone, long bone shaft fragments, and scrap.

Table 6.4. Ratio of identifiable to LBSF and scrap within each occupational phase				
Number **Row %** **Col %** **Total %**	**IDENTIFIABLE**	**LBSF**	**SCRAP**	**Totals**
BYZANTINE	161	12	135	
	52.3%	3.9%	43.8%	308
	0.9%	0.1%	0.6%	0.6%
	0.3%	0.0%	0.3%	
EBA	657	704	254	
	40.7%	43.6%	15.7%	1615
	3.6%	8.7%	1.1%	3.3%
	1.3%	1.4%	0.5%	
EARLY ROMAN	7,295	2,310	12,205	
	33.4%	10.6%	56.0%	21,810
	39.8%	28.6%	53.2%	44.2%
	14.8%	4.7%	24.7%	
HELLENISTIC	1,884	678	3,278	
	32.3%	11.6%	56.1%	5,840
	10.3%	8.4%	14.3%	11.8%
	3.8%	1.4%	6.6%	
IRII	6,969	3,503	5,669	
	43.2%	21.7%	35.1%	16,141
	38.0%	43.3%	24.7%	32.7%
	14.1%	7.1%	11.5%	
LATE BYZANTINE	1,348	851	1,357	
	37.9%	23.9%	38.2%	3,556
	7.3%	10.5%	5.9%	7.2%
	2.7%	1.7%	2.7%	
OTTOMAN	38	32	24	
	40.4%	34.0%	25.5%	94
	0.2%	0.4%	0.1%	0.2%
	0.1%	0.1%	0.0%	
Totals	18,352	8,090	22,922	49,364
	37.2%	16.4%	46.4%	100.0%

Table 6.5. Ratio of identifiable to LBSF and scrap in each excavation area				
Number Row % Col % Total %	**IDENTIFIABLE**	**LBSF**	**SCRAP**	**Totals**
Field A	1,869	1,657	629	
	45.0%	39.9%	15.1%	4,155
	9.0%	17.8%	2.4%	7.3%
	3.3%	2.9%	1.1%	
Field B	17,379	6,419	24,070	
	36.3%	13.4%	50.3%	47,868
	83.5%	69.0%	90.7%	84.5%
	30.7%	11.3%	42.5%	
Field C	1,577	1,226	1,843	
	33.9%	26.4%	39.7%	4,646
	7.6%	13.2%	6.9%	8.2%
	2.8%	2.2%	3.3%	
Totals	20,825	9,302	26,542	56,669
	36.7%	16.4%	46.8%	100.0%

A total of 1918 bones had been modified by cultural or natural processes (**Table 6.6**). Twenty distinct modification categories were recorded within the bone sample. By far the majority of modifications are associated burning, including burned black, gray, brown, and white. Cut marks are the second most common modification identified within the sample, including those that are both burned and cut.

Table 6.6. Bone modifications		
MODIFICATION	**Number**	**%**
BURN	663	34.60%
CUT	379	19.80%
BURN BLACK	349	18.20%
BURN GREY	121	6.30%
CHOP MARKS	73	3.80%
GNAWED	49	2.60%
BURN WHITE	46	2.40%
BURN/CUT	45	2.30%
BURN BROWN	39	2.00%
BURN BLUE/GRAY	34	1.80%
DIGESTED	25	1.30%
DISEASE	23	1.20%
ERODED	18	0.90%
BURN BLUE	15	0.80%
WORKED	12	0.60%
POLISH	14	0.70%
CUT/GNAWED	3	0.20%
IRREG WEAR	3	0.20%
BURN/ERODED	4	0.30%
CONCRETE	1	0.10%
Total	**1,916**	**100.00%**

Fauna Present

Faunal distribution at Tell Madaba is similar to other tell sites throughout the southern Levant. The majority of animals consists of the typical livestock, such as sheep, goats, and cattle. Table 6.7 lists all animals identified within the Tell Madaba faunal sample. Bone distributions throughout the sample indicate sheep and goats were the most abundant species. Interestingly, sheep, goats, and MM make up approximately 87% of the entire sample, while cattle and LM make up only 4.3%. All other animals identified contribute less than 1% to the sample. Because of the difficulty in distinguishing between sheep and goat bones, the category of sheep/goat was used to include all of the bones that could not be positively identified to either animal. Consequently, this category accounts for the majority of sheep and goat bones identified in the sample.

Species identified within the sample represent seven domestic and nine wild species. The ratio between domestic and wild animals indicates that hunting was not an important subsistence strategy at Tell Madaba. Together, chicken and bird bones account for approximately 1.5% of the sample. Seventy-one pig bones were identified, while 68 *Equus* bones, most of which are probably donkey, were recovered. Twenty dog bones and one carnivore tooth were recovered from four different periods. Four camel bones were recovered within the sample. Very few fish and mollusks were identified in the sample, and identified fish and mollusk were most likely by-products of long distance trade since no perennial waters are located near Tell Madaba.

Table 6.7. Faunal distribution within the Tell Madaba faunal sample

Species/Taxa	**Common Name**	**Number**	**%**
	MM	19,099	66.90%
Ovis/Capra	SHEEP/GOAT	6,312	22.10%
	LM	926	3.20%
Ovis aries	SHEEP	519	1.80%
Capra hircus	GOAT	351	1.20%
	SM	322	1.10%
Bos taurus	CATTLE	319	1.10%
Gallus gallus	CHICKEN	225	0.80%
Aves	BIRD	186	0.70%
Equus sp.	HORSE/DONKEY/ONAGER	79	0.30%
Sus scrofa	PIG	71	0.20%
Testudines	TURTLE	54	0.20%
Canis familiaris	DOG	26	0.10%
Gazella sp.	GAZELLE	21	0.10%
Osteichthyes	FISH	19	0.10%
Mullusca	MOLLUSK	7	<0.10%
Camelus sp.	CAMEL	4	<0.10%
Dama dama	DEER	3	<0.10%
Anura sp.	FROG/TOAD	3	<0.10%
Carnavora	CARNIVORE	1	<0.10%
Lacertilia	LIZARD	1	<0.10%
Homo sapien	HUMAN	1	<0.10%
	Total	**28,549**	**100.00%**

CHAPTER 7
ZOOARCHAEOLOGY ANALYSIS

This chapter presents the detailed analyses of the animal production system at Tell Madaba. Therefore, it is pertinent to review the animal production system at Tell Madaba for each occupational phase. Faunal diversity in the Tell Madaba animal bone samples is relatively low; sheep, goat, and cattle are typically the most abundant. In order to conduct the analysis of the faunal remains, it is necessary to compare the relative abundance of the main domestic animals, harvest profiles, and carcass part distributions.

Animal Production and Distribution System During the EBA at Tell Madaba

There is no textual evidence to support any conclusions about Tell Madaba's cultural, historical, or geopolitical place in the region during the EBA; however, historical, social, and geopolitical events throughout the Southern Levant have been outlined in numerous published studies and are discussed in Chapter 4. An increase in urban sites began during the EBA resulting in significant shifts in settlement patterns. Sites located along the Madaba Plains also began to develop more urban characteristics with small villages surrounding larger central town locations. During this time, Madaba may have begun to develop into a major regional center due to its proximity along the King's Highway; a strategic trade route in ancient times.

Faunal Distribution

A total of 1,651 bones were recovered from EBA levels in Field A. Of these, 661 were identified to species or lowest taxonomical category, whereas 254 were only identified as scrap (**Table 7.1**). Sheep and goat dominate the assemblage with 418

identified specimens; however, 57.2% were only identified to sheep/goat. MM represents 32.4% and LM only 0.6% of the sample. Sheep account for 4.5%, while goats are represented by 1.5%. Cattle are the second most abundant identified animal representing 2.3% of the sample. Dog and *Equus* represent only 0.6% and 0.5%, respectively. Only one gazelle bone was recovered from the EBA occupation, suggesting wild game did not play a significant role in EBA subsistence.

Table 7.1. Faunal distribution during the EBA

Fauna	**Number**	**%**
SHEEP/GOAT	378	57.2%
MM	214	32.4%
SHEEP	30	4.5%
CATTLE	15	2.3%
GOAT	10	1.5%
LM	4	0.6%
DOG	4	0.6%
EQUUS	3	0.5%
SM	2	0.3%
GAZELLE	1	0.2%
Total	**661**	**100.00%**

Relative Abundance of the Main Domestic Animals

To compare the ratio of the main domestic animals, all of the EBA sheep/goat, sheep, and goat bones were combined and compared with the cattle bones. In addition, the identified sheep sample was compared to that of goats. The results are listed in Table 7.2. For all three statistical measures the relative abundance for Sheep/Goat and cattle remains there are many more Sheep/Goat than cattle.

Table 7.2. Relative abundance (%) of sheep, goats, and cattle during the EBA					
Sheep/Goat			**Cattle**		
TNF	*MNI*	*RF*	*TNF*	*MNI*	*RF*
96	98	96	4	2	4
Sheep			**Goat**		
TNF	*MNI*	*RF*	*TNF*	*MNI*	*RF*
74	83	75	26	17	25

Furthermore, the percentage of EBA cattle does not fall within Rosen's (1986) intensified agriculture model based on 20% or more cattle. The identified cattle remains were most likely associated with small scale agriculture near the site. The ratios also show that sheep were being utilized more than goats. Since sheep were typically more common near market systems, the EBA goats identified were most likely associated with secondary products. The ratios of Sheep/Goat to cattle and sheep to goats is indicative of a two-fold animal production system, with cattle and goats used mainly for secondary products such as milk, and agriculture.

Harvest Profiles

Too few cattle bones were identified in the sample for constructing harvest profiles. Harvest profiles were constructed for the sheep, goat, and Sheep/Goat sample by utilizing dental wear patterns (Payne 1973) and long bone fusion ages (Hesse and Wapnish 1985 and Silver 1970). The different estimates present slightly different results. Sheep/Goat age distributions based on dental wear indicate approximately 25% were slaughtered between 0 and 1 year (**Figure 7.1**). There was also a substantial slaughter

during the one to three-year interval, or market-age range. This indicates the animal producer's goals served to meet consumer's needs, such as supplying the best cuts and

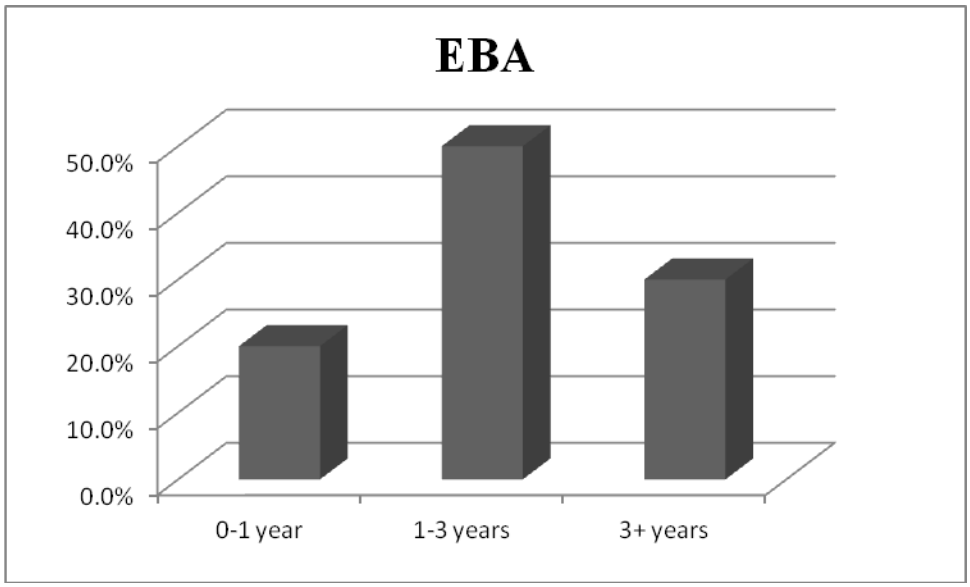

Figure 7.1. Sheep/Goat harvest profiles based on dental wear patterns

prime animals. However, the abundance of Sheep/Goat slaughtered after the age of three is representative of a herd security production system probably related to the significant presence of goats.

Harvest profiles constructed on long bone fusion stages show two significant slaughters (**Figure 7.2**). First, approximately 25% was slaughtered by the end of their first year. The second slaughter stage indicated approximately two-thirds were slaughtered past the age of three. This pattern also indicates a twofold animal production system. Producers were raising sheep and goats for meat and secondary products such as dairy, wool and fiber; hence, an abundance of animals were being maintained into older age.

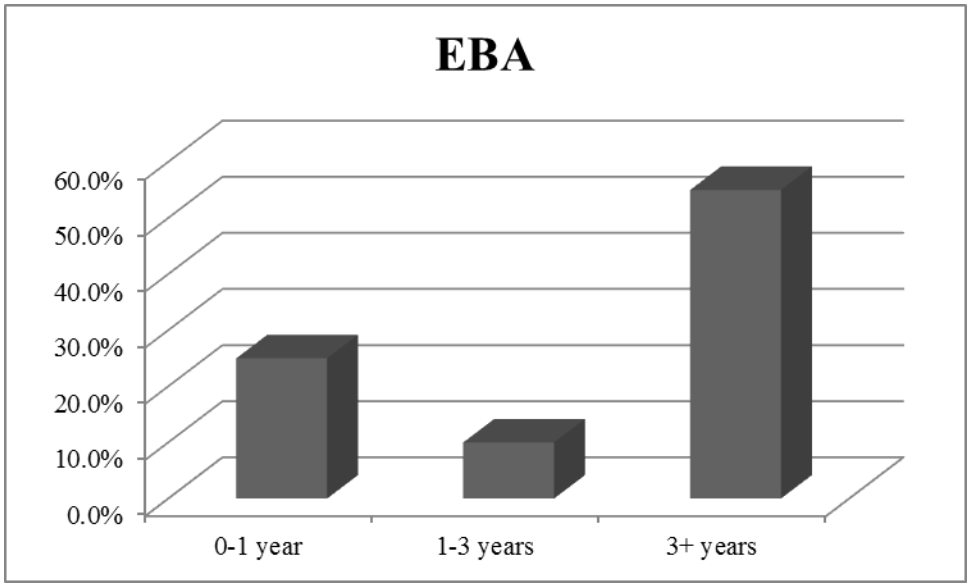

Figure 7.2. Sheep/Goat harvest profiles based on long bone fusion stages during the EBA

Archaeological Animal

Sheep, goat, and sheep/goat bones were combined with the MM and the archaeological animal was compared. The results are shown in Table 7.3. There is a high percentage of meat-bearing bones, such as ribs and limb bones. Axial fragments make up 35% of the sample. Head fragments are the second most abundant category at 33%. Wapnish and Hesse (1991) claim that this pattern is observed when animals are being slaughtered away from the site and redistributed in an indirect market system. Zeder (1988) also suggests that this pattern is associated with an indirect distribution of meat from the herder to the consumer. When hind- and forelimbs are combined they do not outnumber head fragments. Feet are the least represented category at 5.8%. Although head fragments are abundant, slaughter parts are represented as a much higher percentage.

Table7.3. MM carcass part distribution during the EBA		
Skeletal Portion	**Number**	**%**
AXIAL	225	35.5%
HEAD	214	33.8%
FORE	82	12.9%
HIND	76	12.0%
FEET	37	5.8%
Total	634	100.0%
Slaughter	***251***	***39.6%***
Butcher	***383***	***60.4%***

Based on the distribution of carcass parts during the EBA, the occupants had limited access to whole MM carcasses. This indicates that the site was being supplied indirectly by producers and markets. Although, the head is typically viewed as having less meat than other portions of the carcass, it has been shown that in some Near Eastern cultures, such as the modern Druze in northern Palestine, the head of sheep and goats often contain symbolic significance and is consumed (Grantham 1992). Furthermore, modern societies in Jordan often include the head of sheep atop select cuisine when serving guests (personal ethnographic research). Nevertheless, the distribution of slaughtered and butchered parts during the EBA suggests mostly an indirect supply of MM carcass parts at Tell Madaba. The abundance of slaughter parts indicates that some animals were being slaughtered near where they were being consumed.

LM carcass part distributions present a slightly different picture (**Table 7.4**). Forelimbs (35%) are the most abundant carcass part, while head fragments (29%) are the second most abundant. Axial (17%) and foot fragments (11%) are represented in similar

Table7.4. LM carcass part distribution during the EBA		
Skeletal Portion	**Number**	**%**
AXIAL	3	17.6%
HEAD	5	29.4%
FORE	6	35.3%
HIND	1	5.9%
FEET	2	11.7%
Total	17	100.0%
Butcher	***10***	***58.8%***
Slaughter	***7***	***41.2%***

proportions, and hindlimbs (5%) are the least represented category. Although, butchered parts are slightly more abundant, the various proportions indicate that the occupants of Tell Madaba had access to entire LM carcasses during the EBA. This may be a result of localized agriculture occurring near the city proper, and not indicative of dietary preferences. Based on Wapnish and Hesse (1991) and Zeder (1991), LM carcass part distribution patterns indicate that butchery was taking place on-site. This is probably not a reflection of consumer demands versus herder's goals within an indirect market system, instead it is a by-product of local agricultural systems whereby cattle are consumed once they've exceeded their use-life.

EBA Architectural Units

Two distinct EBA architectural phases were identified in 1996 (**Figure 7.3**). The earliest phase consisted of a single wall constructed of unhewn boulder-sized stones. Excavations exposed a 4.75 m section of the wall running northeast across Square 3P21G. It ranged between 0.9 and 1.1 m wide. Currently, it is uncertain whether the structure served as an encircling wall or part of a freestanding building. A possible pavement constructed of cobble-sized stones was uncovered west of the wall.

Concentrations of ash were located east of the wall. A possible doorway was preserved near the southern end of the wall.

The second architectural phase incorporated portions of the earlier wall to form a 3 x 4 m rectangular structure. The contents found in this structure included grinders and a basalt quern; among other objects utilized in food preparation. A pit feature, possibly a hearth, was identified in the center of the structure. Remnants of a raised pavement, consisting of cobble-sized stones, was located adjacent to the hearth. Other items recovered near the structure include a bone awl, ceramic spindle whorls, stone loom weights, and other household items. An intact stone post support and pit were uncovered north of the structure, and a second possible hearth was found to the west. All pottery identified with this structure indicates a late EBA date.

Faunal remains were recovered from the second EBA architectural phase. A total of 281 identifiable bones were associated with this structure (**Table 7.5**). Of these, 86% was identified as sheep/goat, 6% as sheep, 2.8% as goat, and 1.8% as cow. The remaining animals, *Equus*, gazelle, and dog all represent less than 1.5%. An additional 129 specimens were identified as MM, and two each as LM and SM.

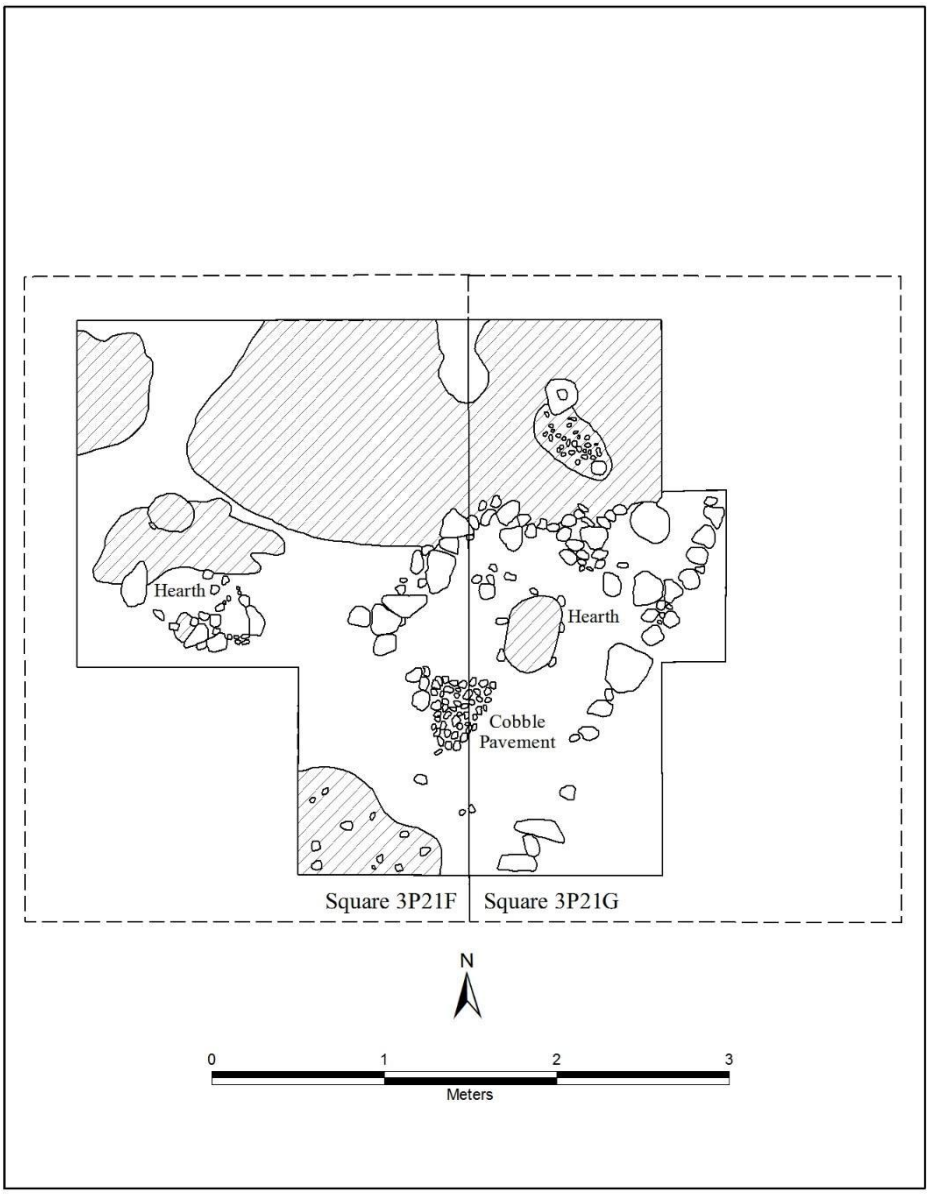

Figure7.3. EBA Structure in Field A

Table7.5. Faunal distribution within the EBA structure in Field A		
Fauna	**Number**	**%**
SHEEP/GOAT	243	86.5%
SHEEP	17	6.0%
GOAT	8	2.8%
CATTLE	5	1.8%
GAZELLE	1	0.4%
EQUUS	3	1.1%
DOG	4	1.4%
Total	**281**	**100.0%**

When assessing MM carcass part distributions (Table 7.6), there is a high percentage of axial (34.7%) and head fragments (33.7%); while feet (4.8%) are not highly represented. The ratio between slaughtered and butchered parts indicates that all carcass parts are present within the structure; however, butchered parts are represented in slightly higher quantities than slaughtered parts.

Table7.6. MM carcass part distributions within the EBA structure in Field A		
Skeletal Portion	**Number**	**%**
AXIAL	138	34.70%
HEAD	134	33.70%
FORE	56	14.10%
HIND	51	12.80%
FEET	19	4.80%
Total	398	100.00%
Butcher	***245***	***61.56***
Slaughter	***153***	***38.44***

LM carcass part distributions are listed in Table 7.7. Very few LM bones were identified within the structure. The most abundant categories are axial and forelimbs which make up approximately 71% of the sample. Head and foot fragments are each represented by a single bone. The dearth of LM bones recovered is most like likely a

direct result of the animal production system which relied more on sheep and goats than cattle.

A large number of bones were associated with this structure. Grantham (1992) states that domestic units should contain a low density of bones, and most contain a much higher proportion of small bones. However, these structures can become a common place for refuse discard after they are abandoned; which may be the case for this structure.

Table7.7. LM carcass part distribution within the EBA structure in Field A

Skeletal Portion	**Number**	**%**
AXIAL	2	28.5%
HEAD	1	14.2%
FORE	3	42.8%
HIND	0	0.0%
FEET	1	14.2%
Total	7	100.0%
Butcher	***5***	***71.4%***
Slaughter	***2***	***28.6%***

Regional Comparisons

The Tell Madaba EBA faunal sample can now be compared with other sites across the Southern Levant (**Appendices A** and **B**). When compared to other sites, a distinct difference in cattle abundance is noticeable at Tell Madaba. Cattle represent only 3% of the identified animals at Tell Madaba; only Arad in the Negev produced a smaller percentage. Generally, cattle account for 9 to 35% of the faunal samples from most EBA sites. Rosen (1986:166) claims that if the abundance of cattle reached 20% or more of all domestic animals, intensified agricultural systems were the primary subsistence focus of the ancient economy. Zeder (1991) and Wapnish and Hesse (1991) agree that a high percentage of cattle points to intensified agricultural practices. Although no agricultural tools have been identified, current results point to a mixed economy that included cereal

farming (wheat and barley), horticulture (primarily grape and olive), and the cultivation of a wide range of legumes (Harrison et al. 2000, 2003).

Hence, the low percentage of cattle identified at Tell Madaba suggests only minor agricultural activity. Furthermore, the ratio between sheep and goats indicates that sheep were more highly represented at Tell Madaba than other sites during the EBA. According to Redding (1991), cattle and goats do not compete for the same resources, but sheep and cattle do. Therefore, intensified agriculture will typically not play a significant role in the subsistence of an animal production system that favors sheep over goats.

Although pigs were relatively abundant throughout the region during the period, they are absent from the Tell Madaba sample as well as four other EBA sites. This is interesting, since pig remains tend to be sparse in the succeeding Iron Age periods, an event usually associated with the arrival of the Philistines and the settlement of the Israelites. Pig is represented as high as 37% at esh-Shuna in the Jordan Valley during the EBAI. Due to the limited amount of information concerning the occupants at Tell Madaba during the EBA, it is highly unlikely that the absence of pig is any indication of ethnicity or religious taboos. It may simply be a reflection of the environmental conditions that affected the use, or non-use, of pigs. This topic is discussed in Chapter 8.

Equus is represented in similar amounts at Tell Madaba as in other sites; except En Shadud in Jezreel where they account for 35% of the sample. Wild game made up between <1 to 12% of the faunal material in EBA contexts. However, only Tel Dan produced more than 5 % (i.e., 12% deer). This suggests that hunting did not play an

important role in the animal economies at most sites during the EBA. Regardless, the occupants at Tell Madaba utilized wild game in similar proportions as seen at other sites.

Animal Production and Distribution System During the IRII at Tell Madaba

During the Iron Age, the region near Madaba became involved in a series of power struggles. The region was constantly being contested for control of the King's Highway; a very strategic north-south trade route. According to biblical texts, King David of Israel defeated a military force consisting of the Aramaeans and Amorites in the region of Madaba (Harrison 1996b:139). Furthermore, the Mesha inscription describes an early 9th century battle where Mesha gained control of Madaba and several other cities from Israel. According to Isaiah 15:2, Madaba was under Moabite control until the end of the Iron Age (Harrison 1996b:2).

Following the urban collapse at the end of the LBA, the early Iron Age experienced the resettlement and development of numerous sites throughout the region, including Madaba and Karak. The resettlement of sites and the emergence of new sites in the area suggest a gradual population movement in southern Transjordan (Herr 1999, 2003). To the north, sites continued to exist along the plateau and Tall al- Umayri and Hisban had a continued occupation into the period. Several newly constructed structures are recorded at Tall al-Umayri including a storeroom, domestic buildings, and an industrial complex (Herr 2003). Newly settled sites along the central plateau include al-Hajjar and Iraq al-Amirand Rujm al-Malfuf.

Faunal Distribution

Fields A and B produced a large number of IRII faunal remains. The vast majority of the sample was recovered from Field B. Table 7.8 summarizes the identified bones

Table7.8. Faunal distribution during the IRII

Fauna	**Number**	**%**
SHEEP/GOAT	2,058	78.4%
SHEEP	226	8.6%
CATTLE	153	5.8%
GOAT	102	3.9%
BIRD	32	1.2%
EQUUS	11	0.4%
PIG	11	0.4%
DOG	7	0.3%
CHICKEN	9	0.3%
SEA TURTLE	8	0.3%
GAZELLE	4	0.1%
FROG/TOAD	3	0.1%
DEER	1	0.0%
Total	**2,625**	**100.0%**
MM	*6764*	**69.8%*
LM	*230*	**2.4%*
SM	*65*	**0.7%*
**represents percentage of total sample*		

assigned to the IRII. The sample consists of 9,684 identifiable bones and LBSF, and 5,669 scrap fragments. There are 2,625 bones identified to species representing seven domestic and five wild species. There were thirteen species exploited during the IRII. Sheep and goats dominate the sample accounting for approximately 84% of all identified animals; most of which are only identified as sheep/goat. Cattle are the third most abundant animal and account for 5.7% of the sample. If MM and LM counts are

combined with the sheep/goat and cattle categories, they account for 97% of the entire sample.

Small to medium-sized birds are the fourth most abundant category of animals during the IRII, nine of which were identified as chicken. Domestic chickens were present, however they were rare during the IRII. It was during the Persian period that chicken became common across the Near East. Pig and *Equus* bones each represent less than 1% of the sample. A small amount of wild game was identified in the IRII sample, representing less than 1%. Most SM fragments identified in the sample are less than 10% of the sample; well below the 20% threshold for intensified agriculture. Nevertheless, the ratio between domestic and wild species suggests that hunting was not a significant aspect of the subsistence at Tell Madaba during the IRII.

Relative abundance of the Main Domestic Animals

All three statistical measures estimate that sheep and goat were utilized to a much greater extent than cattle (**Table 7.9**). Each of the measures also indicate that cattle represented less than 10% of the sample; well below the 20% threshold for intensified agriculture.

Table7.9. Relative abundance (%) of sheep/goat and cattle during the IRII

Sheep/Goat			**Cattle**		
TNF	**MNI**	**RF**	**TNF**	**MNI**	**RF**
93	95	91	7	5	9

A similar result is observed when the three main domestic animals are compared. Table 7.10 lists the results of this comparison. Based on all three statistical measures, sheep and goat dominate the sample of domestic animals. Cattle did not contribute significantly to

Table7.10. Relative abundance (%) of the three main domestic animals during the IRII								
Sheep/Goat			**Cattle**			**Pig**		
TNF	MNI	RF	TNF	MNI	RF	TNF	MNI	RF
94	92	92	5	5	5	1	3	3

the animal production system, however, the small number of cattle was probably related to small scale agriculture outside of the site. As is typical for the IRII, pigs did not contribute significantly to the subsistence at Tell Madaba.

Finally, based on all three statistical measures, sheep are more abundant than goats (**Table 7.11**). However, there is a significant amount of goats present within the sample which can indicate that the animal production system relied heavily on meat from the sheep and by-products, such as dairy from the goats. Although goats were certainly consumed, sheep were more common near ancient urban market systems.

Table7.11. Relative abundance (%) of sheep and goats during the IRII					
Sheep			**Goat**		
TNF	MNI	RF	TNF	MNI	RF
70	75	79	30	25	21

Based on the above results, the occupants at Tell Madaba utilized sheep and goats more than any other animal. Cattle played a very minor role during the period and were probably associated with small scale agriculture located outside the city. Given the moderate abundance of goats, herd security would have played a role in the animal production system since goats are more hearty and do not compete with cattle for grazing. Pigs were insignificant in the animal production system at Tell Madaba during this occupational phase. Essentially, these results point to a two-fold animal production

system supporting Tell Madaba during the IRII, relying on market demands for meat and wool from sheep, and herd security with goats providing meat and secondary products. Limited agricultural products were probably delivered to the site from the surrounding area.

Harvest Profiles

The Sheep/Goat harvest profiles demonstrate that more animals were slaughtered between two and three years of age, and fewer survived past the age of three (**Figure 7.4**). When harvest profiles were calculated based on long bone fusion rates a complementary economic picture emerged. These data also show that few animals were slaughtered before reaching one year of age. Most animals were selected between two and three years of age (**Figure 7.5**). Both methods also indicate a slight tendency for a second slaughter after three years. This suggests that most animals were killed off during their prime market-age, between one and three years.

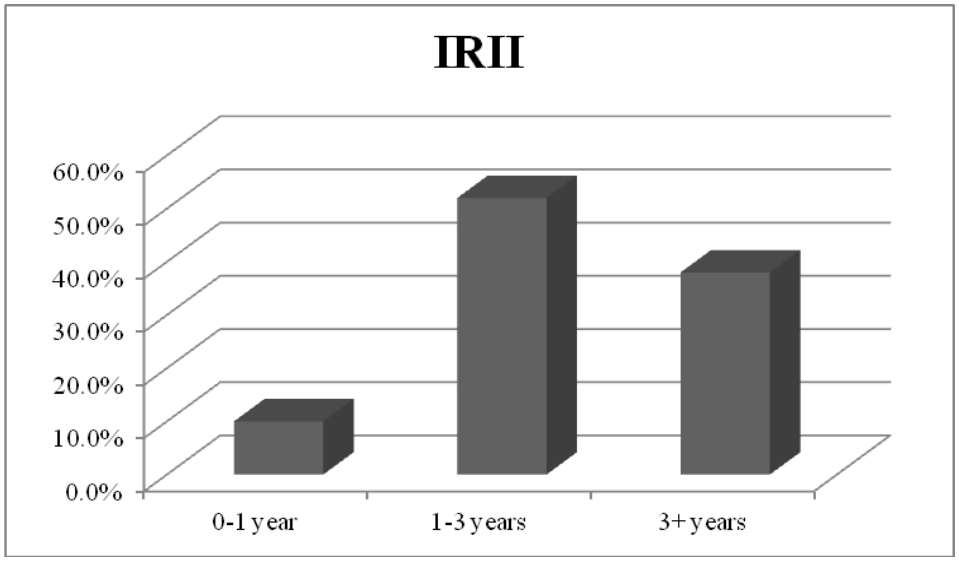

Figure 7.4. Sheep/Goat harvest profiles based on dental wear patterns during the IRII

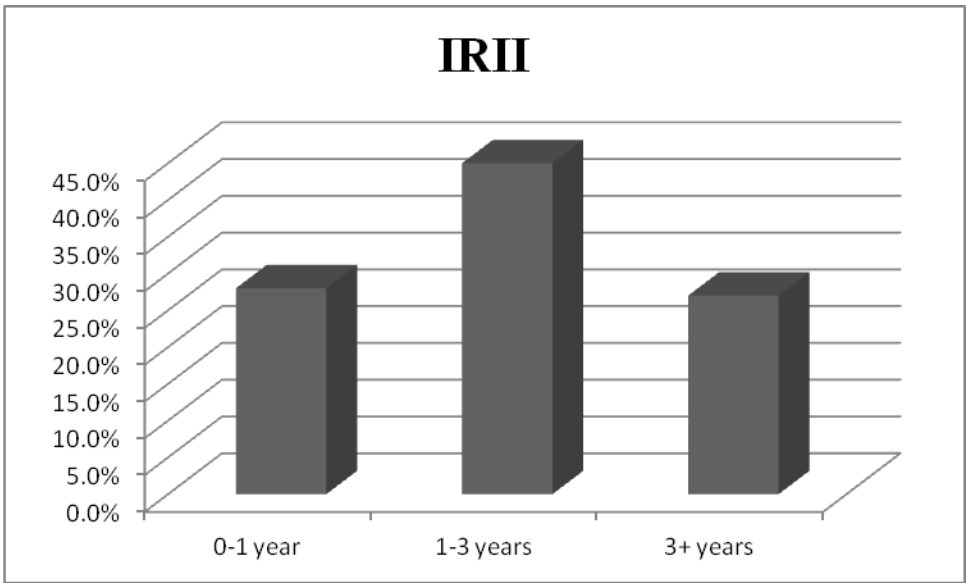

Figure 7.5. Sheep/Goat harvest profiles based on long bone fusion stages during the IRII

This pattern is consistent with a selection strategy directed towards market age animals and herd security. The number of animals being slaughtered after three years of age also suggests that secondary by-products played a major role in the animal production system, affecting the herder's choices about which species and what ages to slaughter. A number of animals would have to have been maintained into old age to provide selective reproduction and by-products. These results also complement the sheep to goat ratios; whereas sheep were being maintained mainly for meat and probably wool and goats for meat and milk.

The cattle harvest profiles, based on long bone fusion, contrasts significantly with the Sheep/Goat sample. Based on the few long bones used to calculate ages, more cattle lived past the age of three than did Sheep/Goat (**Figure 7.6**). This pattern is more

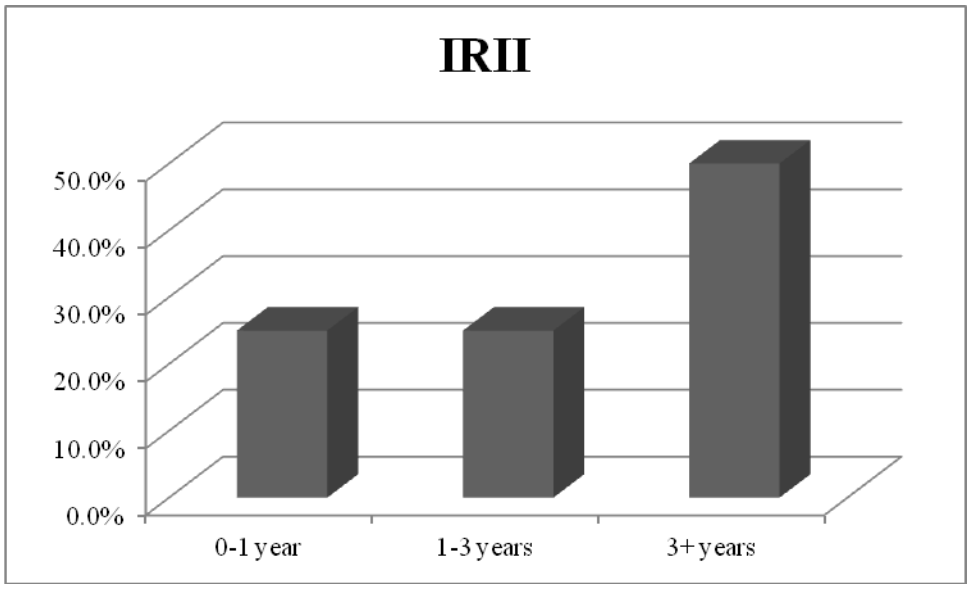

Figure 7.6. Cattle harvest profiles based on long bone fusion stages during the IRII

suggestive of agriculture and draft based cattle, and not primary food sources. Hence, cattle were typically not slaughtered within the prime market age range. However, once they reached the peak of their use-life, they were mostly slaughtered near the site and distributed for food.

The Archaeological Animal

The distribution of MM carcass parts for the IRII is presented in Table 7.12. The results indicate the meatiest parts of the carcasses are the most abundant. Axial bones are the most abundant category with over 53% of the sample (**Table 7.12**). Head fragments are the second most abundant at 17%; however, if both hind and forelimbs are combined they represent the second most abundant category. At only 4%, feet are the least represented body part during the period. Collectively, this indicates a disproportionate

Table7.12. MM carcass part distributions during the IRII		
Skeletal Portion	**Number**	**%**
AXIAL	3382	53.5%
HEAD	1122	17.7%
FORE	794	12.5%
HIND	769	12.1%
FEET	251	3.9%
Total	6318	100.0%
Butcher	***4945***	***78.3%***
Slaughter	***1373***	***21.7%***

amount of butchered parts compared to slaughter parts, suggesting that during the IRII the occupants at Tell Madaba had limited access to entire MM carcasses. It is also suggestive that an indirect redistribution market system supported the occupants of Tell Madaba. MM processing was segregated with animals being raised and slaughtered then delivered to a market system within the city for distribution to consumers. Hence, an indirect market system characterized the MM production and distribution during the IRII.

The distribution of LM carcass parts during the IRII contrasts slightly with the results observed in the MM sample. The results are presented in Table 7.13. Axial fragments (30%) are the most abundant category, followed by head fragments (23%).

Table7.13. LM carcass part distributions during the IRII		
Skeletal Portion	**Number**	**%**
Axial	85	30.36
Head	66	23.57
Fore	32	11.43
Hind	54	19.29
Feet	43	15.36
Total	280	100.00
Butcher	***171***	***61.07***
Slaughter	***109***	***38.93***

Feet (15%) are more abundant than either of the limbs. However, if fore and hindlimbs are combined they account for the most abundant category. The LM sample contained

more slaughtered parts than the MM sample. Based on the ratio between slaughter and butcher parts it is safe to say the IRII occupants at Tell Madaba had more access to whole LM carcasses than MM carcasses. This pattern, coupled with the higher percentage of older animals within the LM sample, suggests that cattle were probably utilized for small scale agriculture, and not as a primary food source during the IRII.

Iron Age II Architectural Units

Between 1998 and 2002 several IRII architectural units were identified in Field B (**Figure 7.7**). Thus far, no IRII architectural units have been recorded in Field A. The earliest IRII structure uncovered was a large fortification wall separating Fields B and C. Prior to the TMAP excavations, the external face of the wall had been exposed by erosion and construction activities. The wall was constructed directly on bedrock and stands over 5-m high. Excavations revealed at least two efforts to expand the width of the wall. One construction phase expanded the wall to 5 m wide. Sediment deposits containing ceramics sealed against the wall suggest this construction effort occurred during the Iron II period, or earlier. This expansion of the wall was constructed directly on top of an earlier expansion that extended the width up to 7-m in some areas.

A room with a large pit in the center containing stones and Late Hellenistic material was uncovered in Field B. The intrusion of Late Hellenistic material was most likely the result of later construction activity that penetrated into IRII deposits. Two surfaces containing flat lying IRII pottery were uncovered below the pit. The walls of the room were constructed with medium-sized unhewn rocks; most of which had slumped

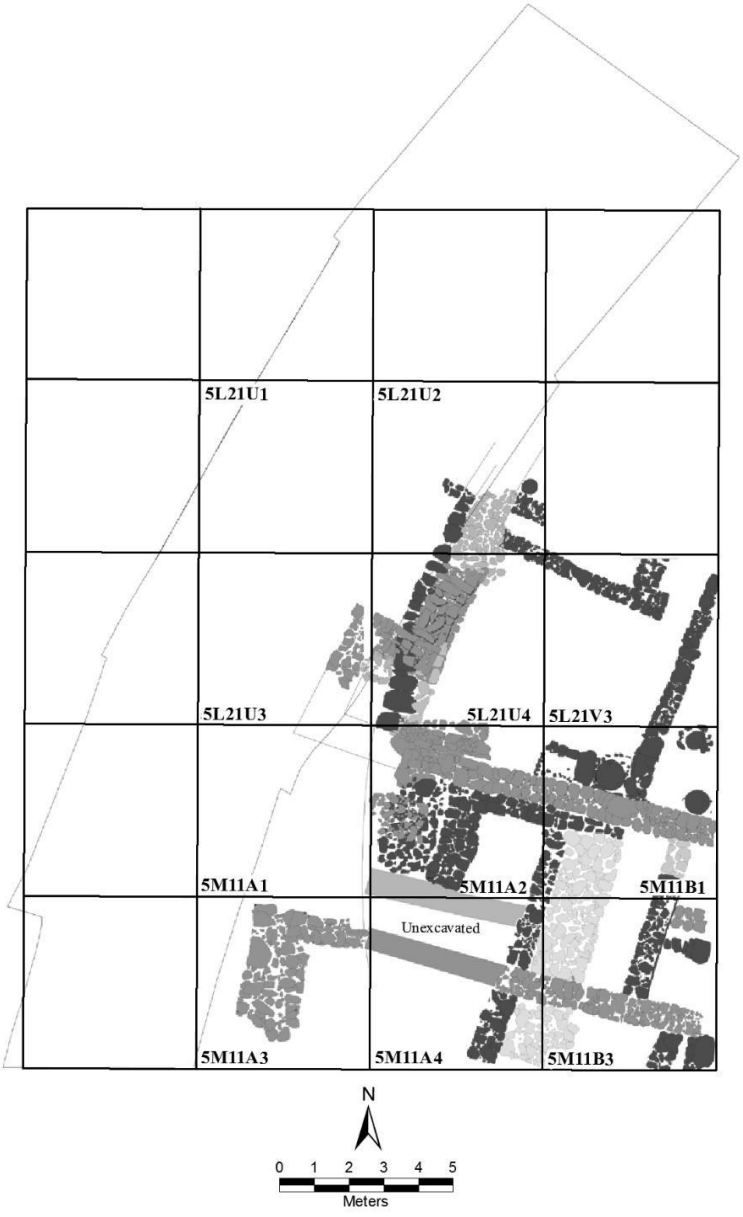

Figure 7.7. Iron Age II Structures in Field B

toward the interior of the room. The upper course of an earlier wall that served as a foundation for the IRII room was uncovered underneath the structure.

A total of 2,356 identifiable bones and 1,103 fragments of scrap were recovered from the room (**Table 7.14**). MM bones represent 84% of the sample. Sheep/Goat (12.1%) is the second most abundant category. Sheep and goats are the most abundant animals identified and are represented in similar amounts. LM (1.7%) is the third most abundant category identified. All other animals represent less than 1% each.

Based on MM carcass part distributions, there is significantly more butcher offal present than slaughter offal (**Table 7.15**). Axial fragments (64.9%) are by far the most abundant category. The hindlimbs are the second most abundant carcass part, while head fragments (12.5%) are the third most common. Feet (5.3%) and forelimbs (4.4%) are the least represented categories. These distribution patterns are similar to those seen throughout the IRII at Tell Madaba. The abundance of butchered parts is probably a direct result of domestic refuse dumping. However, according to Grantham (1992), typically, a high density of discarded bones is not associated with domestic structures.

Table7.14. Faunal distribution with the IRII structure in Field B

Fauna	**Number**	**%**
SHEEP/GOAT	286	12.1%
SHEEP	15	0.6%
GOATS	13	0.6%
CATTLE	12	0.5%
EQUUS	3	0.1%
SM	7	0.3%
MM	1,979	84.0%
LM	40	1.70%
DOG	1	<0.01%
Total	***2,356***	***100.0%***

Table7.15. MM carcass part distributions within the IRII structure in field B		
Skeletal Portion	**Number**	**%**
AXIAL	866	64.9%
HEAD	167	12.5%
FORE	59	4.4%
HIND	172	12.9%
FEET	71	5.3%
Total	1,335	100.0%
Butcher	***1,097***	***82.2%***
Slaughter	***238***	***17.8%***

LM carcass parts are sparse; however, their distributions do provide some interesting comparisons. There is a high percentage of butcher offal present in the sample (**Table 7.16**). Axial (41.5%) and hindlimbs (29.3%) account for the majority of carcass parts identified. Head (14.6%) and toe fragments (12.2%) are represented in similar proportions. Forelimbs (2.4%) are the least represented category. There is also more slaughter offal represented in the LM sample than the MM. This indicates that the occupants of the IRII structure had more access to whole LM carcasses than MM.

Table 7.16. LM carcass part distributions within the IRII structure in Field B		
Skeletal Portion	**Number**	**%**
AXIAL	17	41.5%
HEAD	6	14.6%
FORE	1	2.4%
HIND	12	29.3%
FEET	5	12.2%
Total	41	100.0%
Butcher	***30***	***73.2%***
Slaughter	***11***	***26.8%***

Regional Comparisons

Regional comparisons show a diverse pattern of animal usage during the IRII (**Appendices A** and **B**). The distribution of IRII species across the Southern Levant

indicates a very complex animal production system with few regional or local administration centers drawing animals and agricultural products from nearby satellite and small village sites. Some sites would have produced and supplied large quantities of agricultural products to larger regional centers. There is a major contrast in the abundance of fauna represented. Tell Madaba produced only 5.7% cattle; however, several sites yielded over 20 %. This suggests that intensified agricultural systems sustained much of the region. The IRII Tell Madaba cattle do not fall within the 20% threshold for intensive agriculture. Although no agricultural tools have been identified at Tell Madaba, paleobotanical studies indicate the presence of mixed farming.

Tell Madaba produced one of the highest percentages (92%) of IRII Sheep/Goats. This is not surprising since there are no major water sources needed to support large herds of cattle near the site. This certainly reflects a less intensified agriculture system. However, the presence of cattle at Tell Madaba does suggest that some agricultural activity may have taken place near the site. Pig bones at Tell Madaba are represented in similar, albeit low, percentages at most IRII sites across the region. Most sites produced 2 % or fewer pig bones, with only two sites surpassing 5%. Pigs are represented in very low percentages throughout the Southern Levant. This indicates that pigs were not an important subsistence resource.

Equus is represented in similar abundances across the Southern Levant. Tell Madaba produced less than 1 %. Wild game is also sparse during the IRII. For the most part, sites that produced a higher abundance of wild game also produced lower percentages of sheep/goat and higher percentages of cattle. This is more indicative of an

animal production system based on intensive agriculture. Certain animals, such as sheep and goats, were being raised in the area and supplied to larger centers in the region. In this scenario, the occupants may have supplemented their subsistence with wild game.

Animal Production and Distribution System During the Late Hellenistic Period

Although there's no textual or archaeological evidence for Tell Madaba during the early part of the Hellenistic Period, it is mentioned in Late Hellenistic sources, such as the Book of Macabee (Harrison 1997:139). Madaba was controlled by the Nabataean Kingdom throughout most of the Hellenistic period. In 128/9 BCE, the Hasmonaean's briefly controlled Madaba following their campaign to gain control of sites along the King's Highway. Madaba, along with the other sites, was eventually returned to Nabataean control in exchange for their assistance in the Hasmonaean civil war. Thereafter, Madaba was controlled by the Nabataean Kingdom until the early part of the Roman Period.

Faunal Distribution

A total of 887 bones were identified to species, while an additional 3,278 were only identified as scrap. Table 7.17 lists the identified species. Sheep/goat is the most abundant category represented, while chicken is the second most abundant animal identified. When sheep, goat, and sheep/goat bones are combined they account for 76% of the total number of identified animals. Cattle is the fourth most abundant animal represented in the sample. The assemblage includes 676 sheep and goat bones. Of these, 41 are identified as goat, 34 as sheep, and 601 are indistinguishable between sheep or

Table 7.17. Faunal distributions during the Late Hellenistic Period		
Fauna	**Number**	**%**
SHEEP/GOAT	601	70.7%
CHICKEN	63	7.4%
GOAT	41	4.8%
CATTLE	37	4.4%
EQUUS	37	4.4%
SHEEP	34	4.0%
PIG	13	1.5%
BIRD	12	1.4%
SEA TURTLE	10	1.2%
GAZELLE	1	0.1%
CAMEL	1	0.1%
Total	***850***	***100.0%***
MM	*1,571*	**61.2%*
LM	*109*	**4.2%*
SM	*37*	**4.20*
**represents percentage of total sample*		

goat. Chicken represent 4.6% of the sample; while cattle and *Equus* each made up 4.2%, pig 1.5%, and wild game 2.6%. Only one camel bone was identified in the sample.

The faunal evidence from the Late Hellenistic occupation at Tell Madaba points toward an animal production system focused primarily on secondary products. This system relied more on sheep and goats than any other animal. Chicken was also an important part of the animal production system. Cattle were most likely utilized for small scale agriculture. However, there is a slight increase in the abundance of cattle compared to earlier occupations. This may signal a slight increase in agricultural practices during the Late Hellenistic occupation which may coincide with reoccupation following the Early Hellenistic Period.

Relative Abundance of the Main Domestic Animals

The relative abundance of sheep was compared to goats for the Hellenistic occupation. **Table 7.18** lists the results. Based on all three measures, sheep and goats

Table 7.18. Relative abundance (%) of sheep and goats during the Late Hellenistic Period					
Sheep			**Goat**		
TNF	MNI	RF	TNF	MNI	RF
45	50	53	55	50	47

were utilized in similar proportions, with a slight tendency for goats to be more important. The ratio between sheep and goats during the Late Hellenistic indicates the animal production system was based on herd security, relying on small herds of sheep mainly for meat and goats for secondary products. Additionally, some sheep would have been kept for wool. According to Wapnish and Hesse (1991), if goats are more abundant than sheep the primary product produced is dairy, since goats produce the more desirable milk. In this type of production system meat is not a primary goal for the herders. Instead, they focus on herd security for producing secondary products.

Relative abundance of Sheep/Goat and cattle were compared. The results are shown in **Table 7.19**. Based on all three statistical measures sheep and goats were being utilized much more than cattle. The moderate amount of cattle identified in the sample was probably related to small scale agriculture.

Table7.19. Relative abundance (%) of Sheep/Goat and cattle during the Late Hellenistic Period					
Sheep/Goat			**Cattle**		
TNF	MNI	RF	TNF	MNI	RF
94	89	91	6	11	9

Similar results are observed when the main domestic animals are compared. Based on all three statistical measures, sheep and goats are the most abundant animals

identified (**Table 7.20**). However, based on MNI and RF pigs tend to increase while sheep and goats decrease. This may be an indication that pigs became slightly more important at the expense of other food animals, and due to a small increase in agriculture relative to earlier occupations. However, the overall percentage of pig bones (1.5%) suggests they did not play a significant role in the animal production system. The discrepancy may be the result of identifiability or differential preservation that allowed higher abundances of diagnostically identifiable pig bones to be preserved.

Table7.20. Relative abundance (%) of the three main taxonomic groups during the Late Hellenistic Period

Sheep/Goat			**Cattle**			**Pig**		
TNF	MNI	RF	TNF	MNI	RF	TNF	MNI	RF
93	84	67	5	11	17	2	5	16

Harvest Profiles

Harvest profiles for MM during the Late Hellenistic occupation present interesting contrasts. MM harvest profiles based on dental wear patterns are shown in Figure 7.8. The results suggest there were two significant selection, one of about 45% taken between one to three years of age and another, approximately 35%, taken after animals past three years of age. The majority of animals was slaughtered during the one to three years interval which is highly suggestive of a market-age strategy for slaughtering animals. Furthermore, very few animals were slaughtered during their first year. Animals that lived beyond three years were probably maintained for by-products, such as reproduction, milk, fiber, and wool. This is indicative of a two-fold animal production system associated with consumer market demands and herd security.

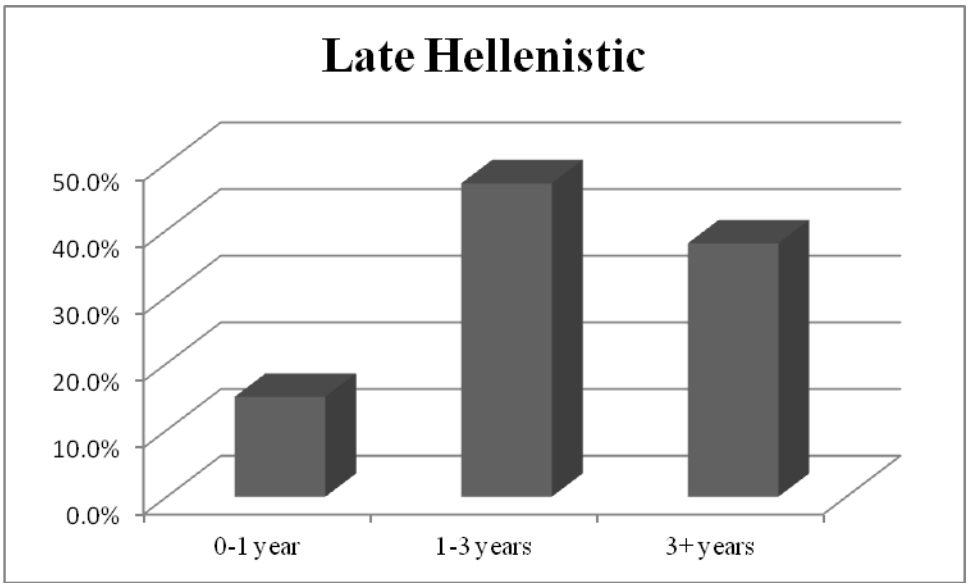

Figure7.8. Sheep/Goat harvest profiles based on dental wear patterns during the Late Hellenistic period

Mortality patterns based on long bone fusion present a similar picture. The results for harvest profiles based on long bone fusion data is shown in Figure 7.9. According to this method, most animals lived past their first year of age and there is an almost even distribution of animals killed off between one and three years of age and those that survived beyond three years.

This pattern also suggests that herders emphasized both flock preservation and market demands. Even though tooth wear patterns suggest a primary selection peak between one and three years, the fusion data shows an almost even distribution between one to three years of age and over three year old animals. These results compliment the nearly equal

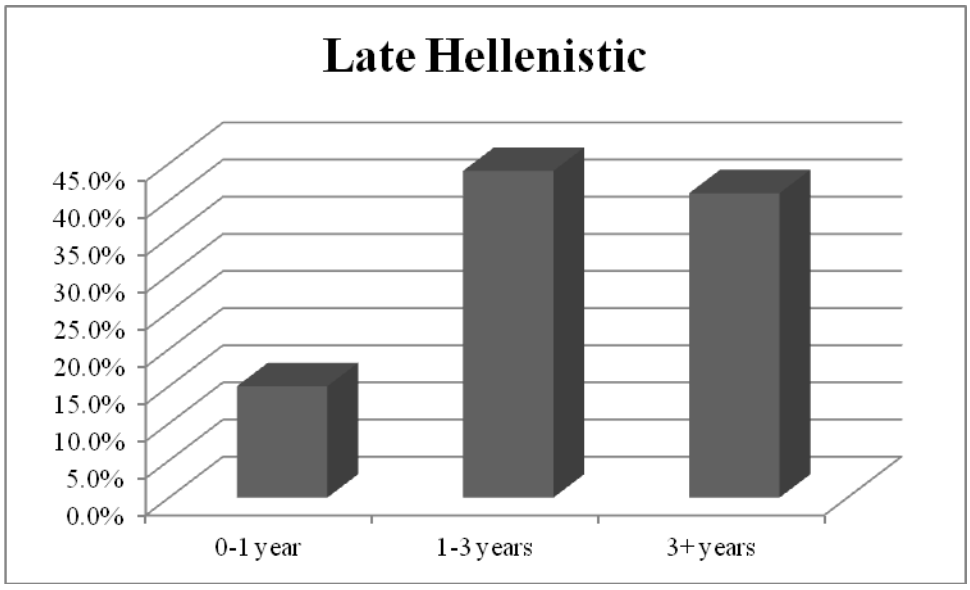

Figure7.9. Sheep/Goat harvest profiles based on long bone fusion stages during the Late Hellenistic period

distribution of sheep and goats. More than likely, goats were being raised for secondary products and utilized as food once they passed their use-life. The smaller abundance of sheep would have supplied the consumer's market demand for higher valued meat.

Harvest profiles were constructed for the 20 cattle long bones identified within Late Hellenistic contexts (**Figure 7.10**). Although the sample is small, a rough profile was generated. The majority of cattle died after three years of age, suggesting they were utilized for secondary products, primarily labor for agriculture. A significant number of cattle was also slaughtered between one and three years of age. Once the cattle reached an age beyond their use-life for agricultural purposes, they may have been slaughtered and distributed to individuals at Tell Madaba. However, the one to three year selection suggests that some cattle were being slaughtered in the prime market age range. This may

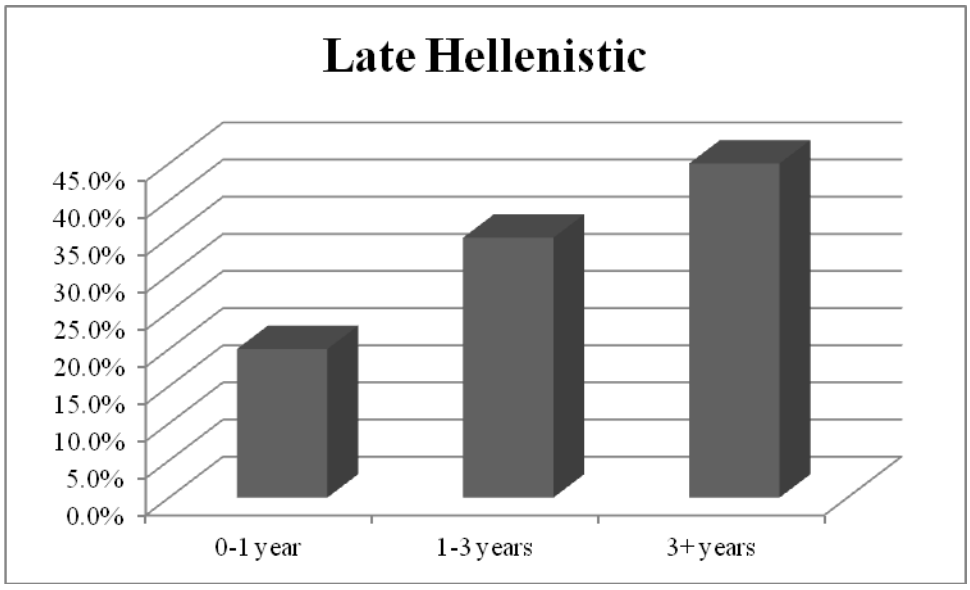

Figure7.10. Cattle harvest profiles based on long bone fusion stages during the Late Hellenistic Period

have been a result of the occupants supplementing their diet due to limited access to the higher valued sheep.

Archaeological Animal

MM carcass part distributions indicate axial bones (52.3%) were the most abundant skeletal part represented during the Hellenistic period (**Table 7.21**). Head fragments (19.4%) are the second most abundant category. However, if forelimbs and hindlimbs (21.0%) are combined they are more abundant than head fragments. Feet (4.26%) are the least represented category.

Table7.21. MM carcass part distributions during the Late Hellenistic Period		
Skeletal Portion	**Number**	**%**
AXIAL	883	55.3%
HEAD	310	19.4%
FORE	189	11.8%
HIND	147	9.2%
FEET	68	4.3%
Total	1,597	100.0%
Butcher	***1,219***	***76.3%***
Slaughter	***378***	***23.7%***

Butchered parts are by far the most abundant category, suggesting the occupants at Tell Madaba had limited access to whole MM carcasses during the Late Hellenistic Period. This is indicative of a complex economic system with MMs being raised near the site, slaughtered, butchered and delivered to consumers primarily through an indirect distribution market.

LM carcass part distributions show a more even distribution of slaughtered and butchered parts during the Late Hellenistic period (**Table 7.22**). This is in direct contrast with the results observed in the MM sample. This pattern is highly suggestive that cattle, albeit in small numbers, were probably being raised in close proximity to the site. This may be a direct result of agriculture or labor building efforts during the Late Hellenistic occupation.

Table7.22. LM carcass part distributions during the Late Hellenistic Period		
Skeletal Portion	**Number**	**%**
AXIAL	28	31.8%
HEAD	33	37.5%
FORE	11	12.5%
HIND	9	10.2%
FEET	7	7.9%
Total	88	100.0%
Slaughter	***40***	***45.5%***
Butcher	***48***	***54.5%***

Architectural Units

Late Hellenistic architectural units were uncovered between 1996 and 2002. A large wall measuring almost 10-m in length runs southeast/northwest across Squares 5M21A2 and 5M11B1 (**Figure 7.11**). This wall may have intersected with a separate, north-south oriented wall uncovered in Square 5M21U4. Based on current interpretations, the two walls may have formed a tower with part of a possible second tower preserved in Square 5M11A3. If this is accurate, the two structures may have been associated with a gateway leading into the city. A series of walls that enclose a large rectangular area that most likely represent a room were also uncovered. Multiple cooking installations and pits containing large quantities of faunal material were located in close proximity to this structure.

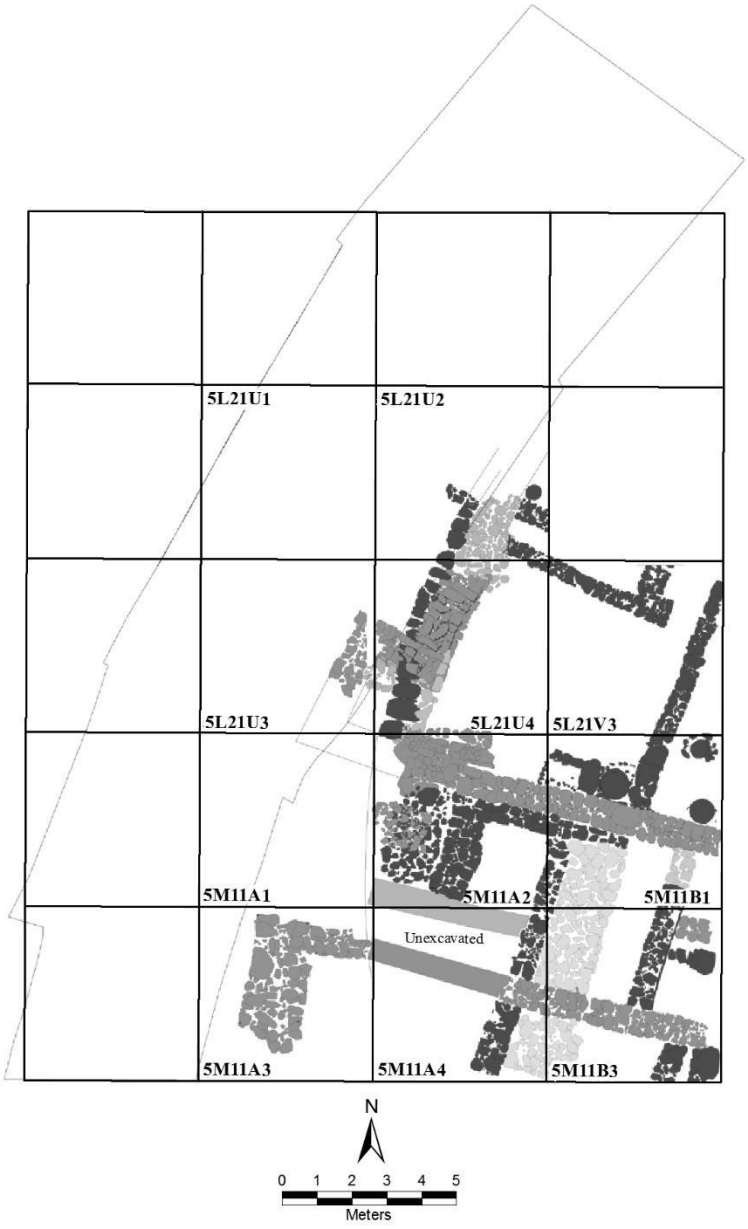

Figure 7.11. Architectural units during the Hellenistic Period

The faunal assemblage from the Late Hellenistic structure consisted of 455 bones identified to species or other taxonomic categories, while an additional 1,863 fragments were not identifiable beyond scrap. Table 7.23 lists the relative abundance of identified animals. The majority of bones recovered were MMs. Sheep and goats represent the most abundant animals (73%), with goats being slightly more abundant than sheep. *Equus* and chicken bones each represent 7.3% of the sample. The distribution of animals within the Late Hellenistic structure does not indicate domestic activity. However, after abandonment it may have become an area where scrap and bones were being dumped. Typically, domestic units contain very few bones and are usually restricted to only those animals and cuts that were consumed as food (Grantham 1992). Structures in close proximity to other domestic units do not typically become dumping areas while occupants are living nearby due to the strong odors and attraction of wild animals. However, some structures become refuse dumps once they are abandoned.

Table7.23. Faunal distribution within the Late Hellenistic architectural unit

Fauna	**Number**	**%**
SHEEP/GOAT	302	66.4%
SHEEP	10	2.2%
GOAT	19	4.2%
CATTLE	21	4.6%
EQUUS	33	7.3%
BIRD	7	1.5%
SM	10	2.2%
PIG	9	2.0%
CAMEL	1	0.2%
CHICKEN	33	7.3%
TURTLE	10	2.2%
Total	455	100.0%

MM Carcass part distributions inside the Late Hellenistic structure show nearly equal portions of butchered and slaughtered parts present (**Table 7.24**). This may be a result of the high number of head fragments present in the sample, which is by far the most abundant category. Additionally, there are very few forelimbs and toe bones present in the sample. Based on Grantham's (1992) predictions, these distribution patterns do not suggest domestic activity. Animal distributions also complement this pattern.

Table7.24. MM carcass part distributions within the Late Hellenistic architectural unit

Skeletal Portion	Number	%
AXIAL	112	39.3%
HEAD	130	45.6%
FORE	5	1.8%
HIND	35	12.3%
FEET	3	1.1%
Total	285	100.0%
Butcher	***152***	***53.3%***
Slaughter	***133***	***46.7%***

Regional Comparisons

Only a limited number of sites have reported Hellenistic faunal data that can be used for regional comparisons (**Appendices A** and **B**). The available data shows Tell Madaba produced the highest percentage of sheep/goat and the lowest percentage of cattle during the period. Pig remains increase significantly during the period, but are still represented in low to moderate abundances. Interestingly, *Equus* increases significantly across the region, and Tell Madaba produced the highest percentage for any Hellenistic site used in this research. Camel and wild game are represented in very low percentages across the region.

Based on the analysis of the animal production systems in place during the Late Hellenistic, and the changing cultural landscape during the period, the faunal assemblage at Tell Madaba has characteristics of a local center producing little in the way of agricultural or animal products. Most of these products were probably delivered from nearby sites and pastoralists. However, the ratio between sheep and goats suggests that the animal production system was primarily based on secondary products from goats and limited high value meat from sheep. Current evidence indicates agricultural activities may have increased near the site, but did not play a major role in the Late Hellenistic economy.

Animal Production and Distribution System During the Early Roman/Nabataean Period

According to inscriptions, Madaba fell under political and cultural control of the Nabataean kingdom until it was annexed into the Roman province of Arabia in 106 CE (Harrison 1996b;139). This event followed the defeat of the Nabataeans at Petra by Trajan (Harrison 1996b). Piccirillo (1989) suggests that Madaba expanded during this time.

Faunal Distribution

The Early Roman/Nabataean faunal sample consists of 2,998 identifiable bones and 12,205 scrap fragments (**Table 7.25**). The identified bones consist of nine domestic and seven wild species. Sheep and goats represent the majority of identified animals and account for 2,484 bones. Of these, 147 are sheep and 142 are goats. The remaining 2,195 were indistinguishable between sheep and goats. In all, sheep and goats make up 83% of

Table7.25. Faunal distribution during the Early Roman Period		
Fauna	**Number**	**%**
SHEEP/GOAT	2195	77.0%
SHEEP	147	5.2%
GOAT	142	5.0%
BIRD	120	4.2%
CHICKEN	106	3.7%
CATTLE	60	2.1%
SEA TURTLE	24	0.8%
PIG	14	0.5%
GAZELLE	12	0.4%
EQUUS	9	0.3%
DOG	7	0.2%
FISH	7	0.2%
CAMEL	3	0.1%
DEER	1	< 0.1%
CARNIVORE	1	< 0.1%
LIZARD	1	< 0.1%
Total	**2849**	**100.0%**
MM	*6330*	**65.4%*
LM	*358*	**3.7%*
SM	*149*	*5.0%*
**represents percentage of total sample*		

all identifiable bones. Interestingly, bones identified only as SM are the second most abundant category. Most of these were extremely fragmented and most were likely related to rodents and other SMs not associated with ancient animal production systems.

Chicken and birds account for 7.5% of the sample, while cattle are represented by only 2.0%. All other identified species represent less than 1% of the sample. The distribution of fauna indicates sheep and goats were utilized to a much greater extent than other animals, and utilized in similar abundances. There is a weak tendency for sheep to be utilized more than goats. The low number of wild game suggests that hunting did not play a major role in subsidizing the diet of the inhabitants during the Early Roman Period.

Relative Abundance of the Main Domestic Animals

Relative abundance of Sheep/Goat and cattle is listed in Table 7.26. Based on all three statistical measures, sheep and goats are represented by 97% of the total sample. This strongly suggests that Tell Madaba relied much more heavily on sheep and goats than cattle during the Early Roman/Nabataean occupation.

Table7.26. Relative abundance (%) of sheep/goat and cattle during the Early Roman Period

Sheep/Goat			**Cattle**		
TNF	**MNI**	**RF**	**TNF**	**MNI**	**RF**
97	97	97	5	3	3

Relative abundance of the three main animals is listed in **Table 7.27**. Sheep/goat represents between 84% and 97% of all the fauna, while cattle represent between 2% and 6%. Pig is the least represented of the main domestic animals. According to all three measures cattle did not reach 20%.

Table7.27. Relative abundance (%) of the three main domestic animals during the Early Roman Period

Sheep/Goat			**Cattle**			**Pig**		
TNF	***MNI***	***RF***	***TNF***	***MNI***	***RF***	***TNF***	***MNI***	***RF***
97	95	92	2	4	6	<1	1	1

When sheep bones are compared to goats, there is a slight tendency for an equal distribution of the two animals (**Table 7.28**). However, based on TNF and MNI, sheep are still slightly more abundant than goats. Most likely, sheep and goats played an equal role in the animal production system during the Early Roman/Nabataean occupation.

Table 7.28. Relative abundance (%) of sheep and goats					
Sheep			**Goat**		
TNF	*MNI*	*RF*	*TNF*	*MNI*	*RF*
51	58	47	49	42	53

The observed ratio between sheep and goats suggests that herd security was the primary goal of herders; hence the abundance of goats. This is indicative of a twofold animal production system, with fewer sheep being used primarily for meat and more goats used for secondary products.

Harvest Profiles

Only the Sheep/Goat sample was large enough to estimate a harvest profile for the Early Roman/Nabataean sample. Harvest profiles based on dental wear patterns are shown in **Figure 7.12**. According to the results, three significant slaughters occurred. First, a high percentage of animals were slaughtered by year one. Next, the largest selection was between 1 and 3 years of age. Finally, the third selection took place after 3 years of age. The younger slaughter pattern is indicative of a dairy producing society which probably coincides with the abundance of goats identified in the sample (Wapnish and Hesse 1991). The higher percentage of older animals in the sample also suggest secondary products played a significant role in the local animal production system. The largest, and most significant, selection took place between 1 and 3 years; the prime market age of animals.

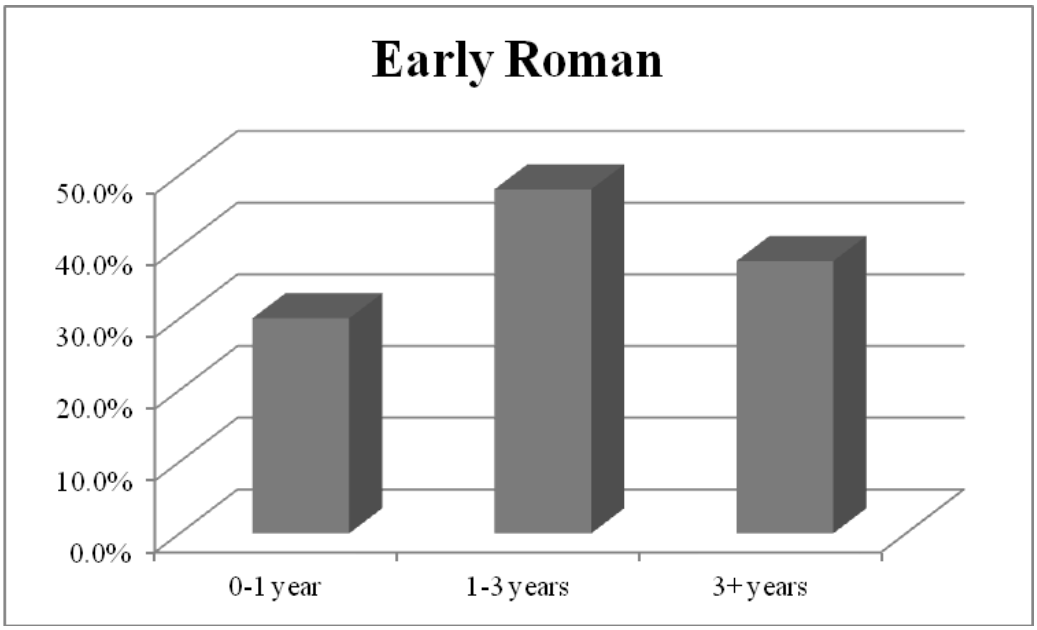

Figure7.12. Sheep/Goat harvest profiles based on dental wear patterns during the Early Roman Period

Long bone fusion patterns present a similar picture with a high percentage of animals being slaughtered during their first year (**Figure 7.13**). Furthermore, a high percentage of animals were living beyond one to three years and into old age. Once again, this is indicative of two primary animal production goals. The first selection is common among milk and dairy producing societies, while the second selection, after three years of age, is common among wool and fiber producing societies. This coincides with the nearly equal distribution of sheep and goats and the abundance of cattle.

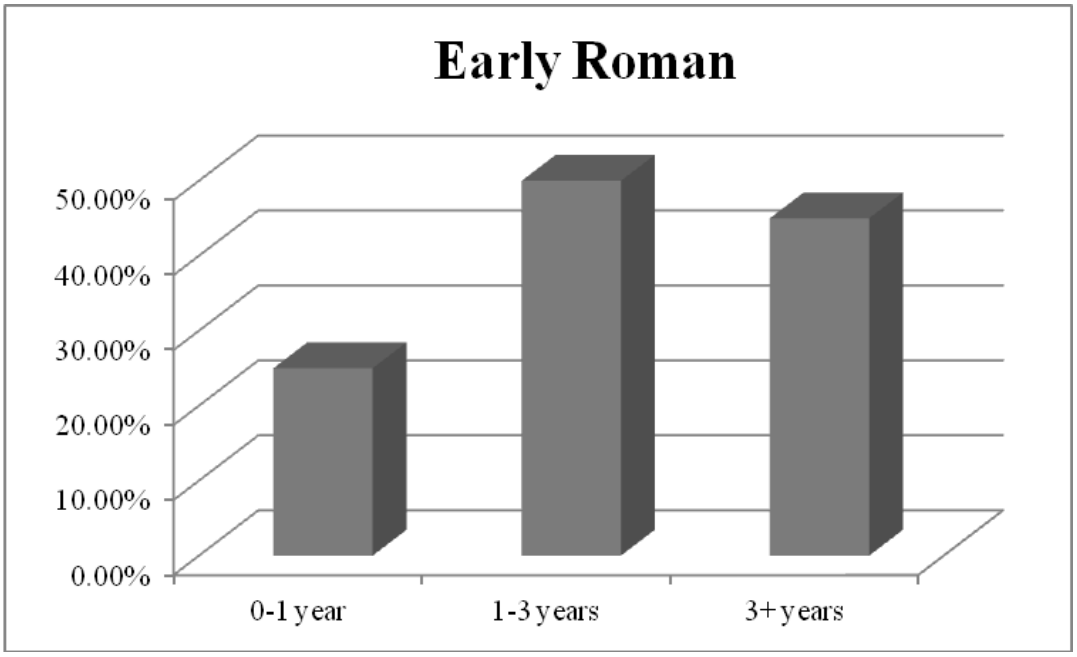

Figure7.13. Sheep/Goat harvest profiles based on long bone fusion patterns during the Early Roman Period

The Archaeological Animal

MM carcass part distributions are shown in Table 7.29. Axial fragments (55.9%) are the most abundant category, while head fragments (18.0%) are the second most abundant. If both limb categories are combined they account for a higher percentage than head fragments. Regardless, butchered parts are represented in a much higher percentage than slaughtered parts. This is indicative of an indirect supply of MM carcasses associated with a redistribution market system.

Table7.29. MM carcass part distributions during the Early Roman/Nabataean Period		
Skeletal Portion	**Number**	**%**
AXIAL	3679	55.9%
HEAD	1,184	18.0%
FORE	783	11.9%
HIND	656	9.9%
FEET	269	4.0%
Total	6,571	100.0%
Butcher	***5,118***	***77.9%***
Slaughter	***1,453***	***22.1%***

Carcass part distributions for LMs during the Early Roman/Nabataean occupation are shown in **Table 7.30**. Axial fragments (44.3%) are by far the most abundant category, while head fragments (13.7%) are much less represented than seen in the earlier occupations. When compared, butchered parts are much more abundant during this time period. This pattern indicates that the occupants during this period had limited access to entire LM carcasses. More than likely, cattle were being used for agricultural and drought activities outside the city and being slaughtered for food after they exceed their use-life. The high percentage of butcher parts also can indicate that the inhabitants were supplementing their diets with cattle due to limited access to sheep.

Table7.30. LM carcass part distributions during the Early Roman Period		
Skeletal Portion	**Number**	**%**
AXIAL	90	44.3%
HEAD	28	13.7%
FORE	32	15.7%
HIND	38	18.7%
FEET	15	7.3%
Total	203	100.0%
Butcher	***160***	***78.8%***
Slaughter	***43***	***21.2%***

Architectural Units

Early Roman architectural remains in Field B were first identified in Square 5M11A4, where a well-preserved complex was found consisting of a courtyard paved with heavily worn flagstones (**Figure 7.14**). The courtyard was bordered on the north by a walled structure with a stepped threshold. Late Ottoman pitting activity removed most of this structure. However, a series of thinly laminated floors and a cluster of three or four tabun/ovens in the southwest corner of the building were delineated during the excavations. A single course second wall lined the eastern edge of the paved courtyard which continued to the south and west out of the square. A single column fragment was uncovered near the center of the courtyard.

A total of 315 bones were recovered from the floor of this structure. Of these, only 84 were identifiable, 12 were identified as long bone shaft fragments, and 219 could only be labeled scrap. The high percentage of scrap is indicative of significant taphonomic process, such as trampling, affecting the bones once they were discarded.

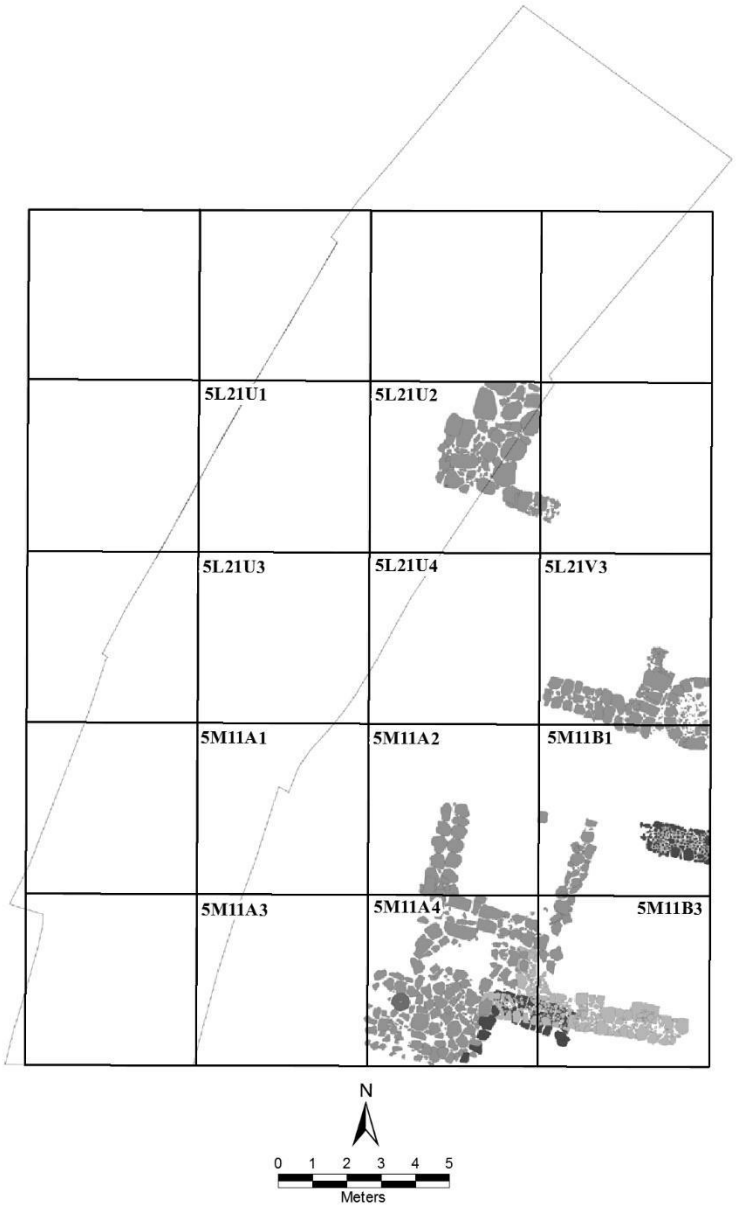

Figure 7.14. Architectural units in Field B during the Early Roman Period

Faunal distribution within the structure is extremely low. Sheep, goats, and MM account for 99% of the sample (**Table 7.31**). It is almost certain that all MM bones are either sheep or goats. Goat bones are slightly more abundant than sheep. No cattle bones were identified within the structure; however, one LM bone was present which probably represents cattle. The low abundance of species can be indicative of domestic activities (Grantham 1992).

Table7.31. Faunal **d**istribution		
Fauna	**Number**	**%**
SHEEP/GOAT	21	29.2%
SHEEP	2	2.1%
GOAT	5	5.2%
MM	67	69.8%
LM	1	1.0%
Total	**96**	**100.0%**

Too few identifiable bones were recovered from the Early Roman structure to use in carcass part distribution analysis. The 29 sheep and goat bones identified were mostly axial and head fragments. No foot bones were identified. The distribution of bones, species, and carcass parts match Grantham's (1992) model for domestic use.

Regional Comparisons

Regional comparisons based on available data for the Roman period indicate a contrast within the animal production system observed at Tell Madaba relative to other sites (**Appendices A** and **B**). Tell Madaba produced the highest percentage of sheep/goat and the least amount of cattle. Although somewhat insignificant, *Equus* bones are represented in a higher abundance at Tell Madaba than identified elsewhere. All other

animals, (i.e., pig, camel, and wild game) are represented in very low percentages. Sheep and goats are represented in nearly identical proportions. This data suggests that during the Early Roman/Nabataean occupation Tell Madaba probably remained a small regional or local center; however, the animal production system may have shifted slighted with an emphasis on herd security and secondary products as a result of slightly diminished importance in the region. As a result, cattle were probably consumed as a means to supplement diets. Nevertheless, with the small number of cattle represented, it is highly unlikely that agriculture played a significant role at Tell Madaba during the period.

Animal Production and Distribution System During the Byzantine Period

During the mid-fifth century Byzantine Period, Christianity appeared in the Madaba region. Christianity continued to grow during this time and a bishop was established at Madaba. The town was established as the seat of a diocese but is not mentioned throughout the remainder of the period. However, Madaba functioned as an important town in the region, as illustrated by the numerous churches and public buildings that were constructed during the sixth and seventh centuries CE (Harrison 1996b:139). Many mosaics were assembled during this time across the site. These mosaics portrayed animals, people and towns. The most impressive examples of Byzantine mosaic artistry can be seen in Madaba, and the greatest of these is the famed sixth century Map of the Holy Land, also known as the Mosaic Map of Palestine.

Faunal Distribution

Faunal distribution during the Byzantine Period is quite low relative to the other occupational phases. A total of 109 bones were identifiable, and an additional 135 were identified only as scrap (**Table 7.32**). The identifiable bones account for only seven species, five domestic and two wild. Sheep and goat bones dominate the sample with 78.8% of the bones, of which only three were identified as sheep and no goat bones were identified. Chicken reach their highest percentage during this period at 7.3%. Pig is also represented in a relatively high percentage at 3.7%. Only one cattle bone was identified within the Byzantine period.

Table7.32. Faunal distribution during the Byzantine Period.

Fauna	**Number**	**%**
SHEEP/GOAT	83	79.0%
CHICKEN	8	7.6%
EQUUS	5	4.8%
PIG	4	3.8%
SHEEP	3	2.9%
CATTLE	1	1.0%
FISH	1	1.0%
Total	**105**	**100.0%**
MM	*64*	**37.0%*
LM	*0*	**0%*
SM	*4*	**3.7%*
**represents percentage of total sample*		

Given the small sample for the Byzantine Period it is difficult to make general assumptions. However, a few observations can be pointed out and discussed. Based on the number of sheep/goat and MM bones it is safe to say that sheep and goats were probably the most utilized animals. The lack of any LM bones and only a single cattle bone suggests that cattle did not play a significant role in the animal production system.

Only a single fish bone was recovered from Byzantine contexts. The presence of fish may suggest limited long distance trade.

Relative Abundance of the Main Domestic Animals

The small number of identified bones from the Byzantine Period restricts the analysis. No goat bones were identified within the sample; however, it is possible that some of the bones within the sheep/goat and MM categories are goat. When Sheep/Goats and cattle are compared Sheep/Goats were represented in much higher proportions (**Table 7.33**). The three statistical measures are not entirely consistent and based on MNI and RF, cattle are represented in higher proportions than indicated by TNF. This may be a result of the limited and fragmented nature of the sample. When the main domestic animals are compared it appears that sheep and goat decline based on the presence of pigs (**Table 7.34**). Once again there is a slight inconsistency with the three statistical methods. RF indicates that cattle are represented in equal proportions as sheep and goats, while pigs are also represented in a large abundance.

Table7.33. Relative abundance (%) of sheep/goat and cattle during the Byzantine Period

Sheep/Goat			**Cattle**		
TNF	MNI	RF	TNF	MNI	RF
99	75	80	1	25	20

Table7.34. Relative abundance (%) of the main domestic animals during the Byzantine Period

Sheep/Goat			**Cattle**			**Pig**		
TNF	MNI	RF	TNF	MNI	RF	TNF	MNI	RF
95	60	40	1	20	40	4	20	20

The Archaeological Animal

MM carcass part distributions for the Byzantine period are based on a limited sample of identified bones. Table 7.35 lists the MM carcass part distributions. Axial fragments (57.2%) are by far the most abundant category while the combined limb bones (21.0%) are the second most abundant, with head fragments (15.2%) being the third most abundant. These distribution patterns show that butchered parts are more abundant than slaughtered parts, indicating that during the Byzantine Period the occupants at Tell Madaba had limited access to whole MM carcasses. This suggests an indirect supply of meat throughout the period. Unfortunately, no age profiles can be generated for the period which would provide some insight into the overall animal production goals. Due to the limited cattle and LM bones identified, no carcass part distributions were calculated for the Byzantine period.

Table7.35. MM carcass part distributions

Skeletal Portion	**Number**	**%**
AXIAL	79	57.2%
HEAD	21	15.2%
FORE	10	7.2%
HIND	19	13.7%
FEET	9	6.5%
Total	138	100.0%
Butcher	***108***	***78.3%***
Slaughter	***30***	***21.7%***

Regional Comparisons

The Byzantine deposits at Tell Madaba yielded a very limited number of faunal remains, and only 93 could be used for regional comparisons (**Appendices A** and **B**).

However, a couple of inferences can be made. Sheep/goat continues to be represented in high percentages during the period. Cattle remains tend to decrease significantly, with fewer identified at Tell Madaba than anywhere else in the region. Pig and Equus are represented in higher percentages, relative to Tell Madaba, but still do not exceed the higher percentages seen at other sites.

Animal Production and Distribution During the Late Byzantine/Early Islamic Period

The Byzantine Empire became engulfed in protecting its interest in Constantinople and the surrounding area while trying to regain control over the western part of the empire, including Rome. This preoccupation weakened the empire's forces and eventually led to the removal of the Byzantine occupation from the Near East. Earthquakes and other natural catastrophes also severely affected the already weakened empire (Whitcomb 2001). Soon, the Byzantine administration was completely replaced with Islamic occupations which showed a collectively more organized form of rule.

After the Islamic conquest and the development of the Umayyaad Caliphate during the mid-seventh century, the established town of Madaba flourished (Harrison 1996b:139). Several former Byzantine churches were renovated. The town continued to function as the seat of a Bishop. Mosaics in the Church of St. Stephen list two bishops from Madaba during the Abbasid Caliphate, Job in AD 756 and Sergius II in AD 785 (Piccirillo 1987: 180-86). Unfortunately, other events documented by the Caliphates in the region of Madaba do not mention the site (Hutteroth and Abdulfattah 1977). Also, the

literary sources fail to mention Madaba between the ninth and early nineteenth centuries when westerners began exploring Transjordan (Harrison 1996b). Furthermore, there is no mention of Madaba in the early Ottoman tax records (Hutteroth and Abdulfattah 1977). However, Madaba remained a major site in the area for Christians. A Late Ottoman building excavated between 1998 and 2000 illustrates the resettlement of Madaba by migrating families from Kerak in the late nineteenth through early twentieth centuries (Harrison 1996b). In addition, the survey conducted by Harrison (1996a) suggests that, although limited, there was some activity at Madaba during the Ayyubid throughout the Ottoman periods.

Faunal Distribution

A total of 299 bones were identified to species from the Late Byzantine/Early Islamic occupation. This includes twelve different animals; seven domestic and four wild animals (**Table 7.36**). One human radius was identified within the samples, but no burial or tomb was identified during the excavation. An additional 1,357 bones were identified only as scrap. Sheep and goat dominate the sample represented with 213 bones, of which 20 are identified as sheep and 16 as goat. Cattle bones are represented by 2.0%. Pig bones are relatively abundant at 6.4%, while *Equus* and birds are each represented by only 1 % of the sample, and deer is less than 1%. The fish represents 3.3%, suggesting long distance trade. Chicken and birds are represented by extremely low percentages. Wild game is also represented in small percentages suggesting they were insignificant during the period.

Table7.36. Distribution of fauna remains during the Late Byzantine/Early Islamic Period		
Fauna	**Number**	**%**
SHEEP/GOAT	177	66.0%
SHEEP	20	7.5%
PIG	19	7.1%
GOAT	16	6.0%
FISH	10	3.7%
TURTLE	9	3.4%
CATTLE	6	2.2%
EQUUS	3	1.1%
BIRD	3	1.1%
DOG	2	0.7%
DEER	1	0.4%
CHICKEN	1	0.4%
HUMAN	1	0.4%
Total Identified	**268**	**100.0%**
MM	*1814*	**82.4%*
LM	*88*	**4.0%*
SM	*31*	**10.4%*
**represents percentage of total sample*		

Pig bones are represented in high percentages (6.4%). This is interesting since this period is represented by two contrasting cultures, Byzantine and Islamic. There was no strictly enforced prohibition against pork in Byzantine Christianity; however, in the Islamic religion pork is forbidden. The abundance of pig coupled with the fact that Madaba maintained a Bishopric during the period suggests there was still a strong Byzantine presence at Tell Madaba.

Relative Abundance of the Main Domestic Animals

MM represents over 80% of the sample, while LM only represents 4%. Based on the identified fauna, cattle are not well represented, but when combined with LM they are more abundant than any other category except MM (**Table 7.37**). When the

Table7.37. Relative abundance (%) of sheep/goat and cattle during the Late Byzantine					
Sheep/Goat			**Cattle**		
TNF	**MNI**	**RF**	**TNF**	**MNI**	**RF**
97	78	84	3	22	16

Sheep/Goat and cattle are compared, Sheep/Goats are significantly more abundant. However, each method presents slightly different results. MNI and RF both indicate cattle are much more abundant than TNF. This discrepancy may be a result of differential preservation, since very few cattle bones were identified. However, if MNI and RF are accurate measures then cattle possibly exceeded Hesse's (1995) and Rosen's (1986) models for intensive agriculture.

When the main domestic animals are compared, all three statistical measures present contrasting results (**Table 7.38**). Each one estimates that sheep and goats are the most abundant animals with THF and MNI indicating pig as the second most abundant. However, MNI and RF show a significant increase in pig and a sharp decrease in sheep and goats. TNF indicates that cattle are the second most abundant animal. Regardless, each method suggests that sheep and goats were the most abundant animals.

Table7.38. Relative abundance (%) of the three main domestic animals during the Late Byzantine								
Sheep/Goat			**Cattle**			**Pig**		
TNF	**MNI**	**RF**	**TNF**	**MNI**	**RF**	**TNF**	**MNI**	**RF**
89	67	44	3	11	33	8	22	22

When all the sheep and goat bones are compared a familiar picture emerges. All three statistical measures are similar in their estimates (**Table 7.39**). Sheep and goats are represented in similar proportions, with sheep being slightly more abundant based on

Table7.39. Relative abundance (%) of sheep and goats during the Late Byzantine

Sheep			Goat		
TNF	**MNI**	**RF**	**TNF**	**MNI**	**RF**
53	50	57	47	50	43

TNF and RF. This in combination with the fact cattle possibly reached over 20% is suggestive that an intensified agricultural economy was in place during the Late Byzantine/Early Islamic occupation. The ratio between sheep and goats is indicative of an animal production system focused on herd security and secondary products. Goats were important for the occupants as a means to obtain dairy and other by-products, while limited sheep may have been available for meat. Furthermore, pig is represented in unusually high abundances suggesting they too may have been consumed as a supplement to the limited access to sheep.

Harvest Profiles

Harvest profiles for Sheep/Goat during the Late Byzantine/Early Islamic occupation presents contrasting results. Dental wear patterns indicate that very few animals were being slaughtered in their first year, while a very high percentage of animals were slaughtered between one and three years (**Figure 7.15**). Also, a high percentage of animals survived past three years, suggesting that meat and secondary products were the

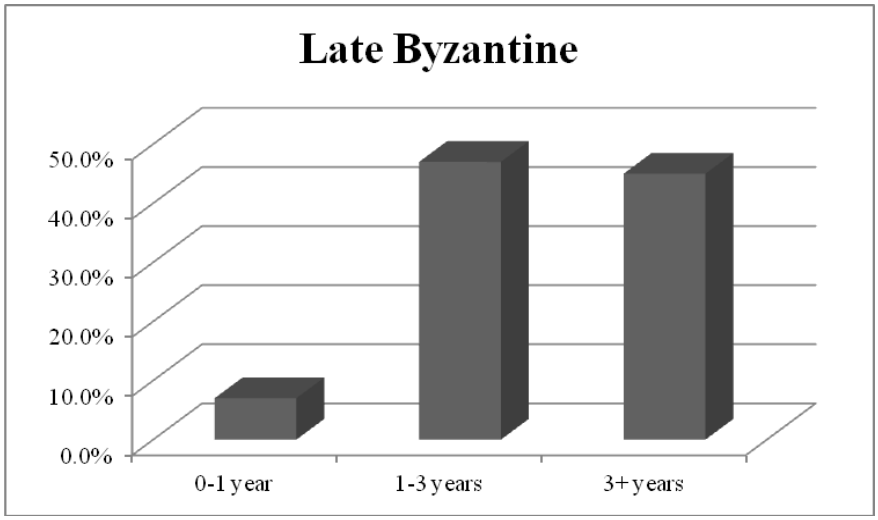

Figure7.15. Sheep/Goat harvest profiles based on dental wear patterns

two primary goals for the animal production system. However, when the long bone fusion age profiles are compared, many more animals appear to have been slaughtered after three years of age, while a high percentage of animals were slaughtered between one and three years (**Figure 7.16**). Age profiles based on long bone fusion compliments tooth

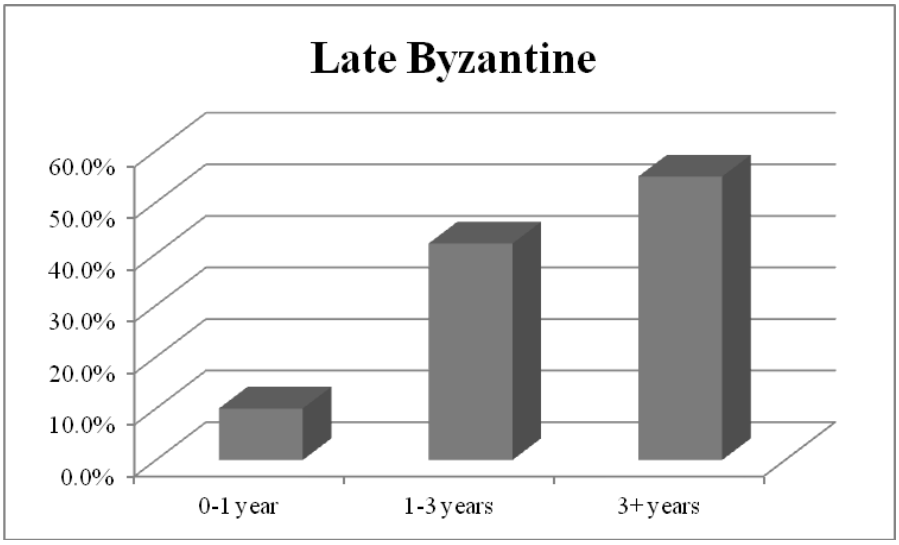

Figure7.16. Sheep/Goat harvest profiles based on long bone fusion

wear patterns, with a high percentage of animals living into old age. This also correlates to the patterns seen in the distribution of fauna, with goats being an important factor in an animal production system focused on secondary products thus allowing more animals to grow older.

Mortality rates for cattle based on long bone fusion stages during the Late Byzantine/Early Islamic occupation show a high percentage of animals living into old age, beyond the preferred market age for meat (**Figure 7.17**). The vast majority of

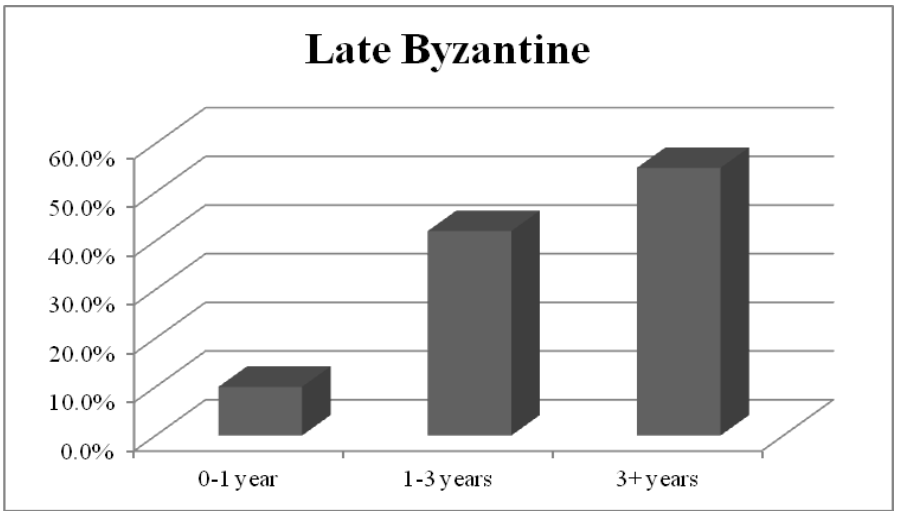

Figure 7.17. Cattle harvest profiles based on long bone fusion stages during the Late Byzantine/ Early Islamic Period

animals lived beyond three years of age, while a significant amount also died between one and three years of age. This profile suggests two culls, first between one and three years of age which is indicative of a meat based economy, and a second larger cull after three years, suggesting secondary products, in this case most likely labor. Cattle were more than likely utilized for other products or by-products. With cattle reaching utilization between 10 and 20% an intensive agricultural system supporting Tell Madaba

probably played a significant role in the economy. This, coupled with the abundance of cattle culled between one and three years of age, strongly suggests the inhabitants may have consumed cattle due to the fact that fewer higher value animals such as sheep were available.

The Archaeological Animal

Based on carcass part distributions for MM, axial (68.3%) is by far the most abundant category represented in the sample (**Table 7.40**). Head fragments (12.6%) are the second most abundant, unless all the limb bones are combined. However, limb bones and head fragments are represented in similar proportions. Feet (5.4%) are the least represented category within the sample. Carcass part distributions create a major contrast in the ratio between slaughter and butcher parts. Butcher parts are represented to a much greater extent than slaughter, indicative of an indirect supply of MM carcass parts.

Table7.40. MM carcass part distributions during the Late Byzantine/Early Islamic Period

Skeletal Portion	**Number**	**%**
AXIAL	817	68.3%
HEAD	151	12.6%
FORE	92	7.7%
HIND	70	5.8%
FEET	65	5.4%
Total	1195	100.0%
Butcher	***979***	***81.9%***
Slaughter	***216***	***18.1%***

LM carcass part distributions contrast significantly with the MM (**Table 7.41**). Head fragments (56.1%) are by far the most abundant category represented, and feet

(14.6%) are the second most abundant. However, if combined, limb bones would represent the second most abundant category within the sample. There is significantly more slaughtered parts present than butchered parts, suggesting that during this period the inhabitants at Tell Madaba had more access to entire LM carcasses. This contrasts with the patterns seen in the ratio of sheep and goats. Based on harvest profiles, some cattle were being slaughtered at the market age, hence some were being slaughtered near the site and consumed. This may be a result of increased agriculture and the abundance of goats whereas the occupants supplemented their diet with cattle due to the limited amount of sheep available. However, if there was 33% cattle, more than likely they would have been utilized for labor within the intensive agricultural system.

Table7.41. LM carcass part distributions during the Late Byzantine/Early Islamic occupation

Skeletal Portion	**Number**	**%**
AXIAL	5	12.2%
HEAD	23	56.1%
FORE	2	4.8%
HIND	5	12.2%
FEET	6	14.6%
Total	41	100.0%
Butcher	***12***	***29.3%***
Slaughter	***29***	***70.7%***

Architectural Units

The remnants of a large Late Byzantine/Early Islamic structure were uncovered in Field C during the 1998 through 2000 seasons (**Figure 7.18**). A series of small retaining walls were also uncovered in Field C. These were isolated to Squares 5L22S4, 5L22T3,

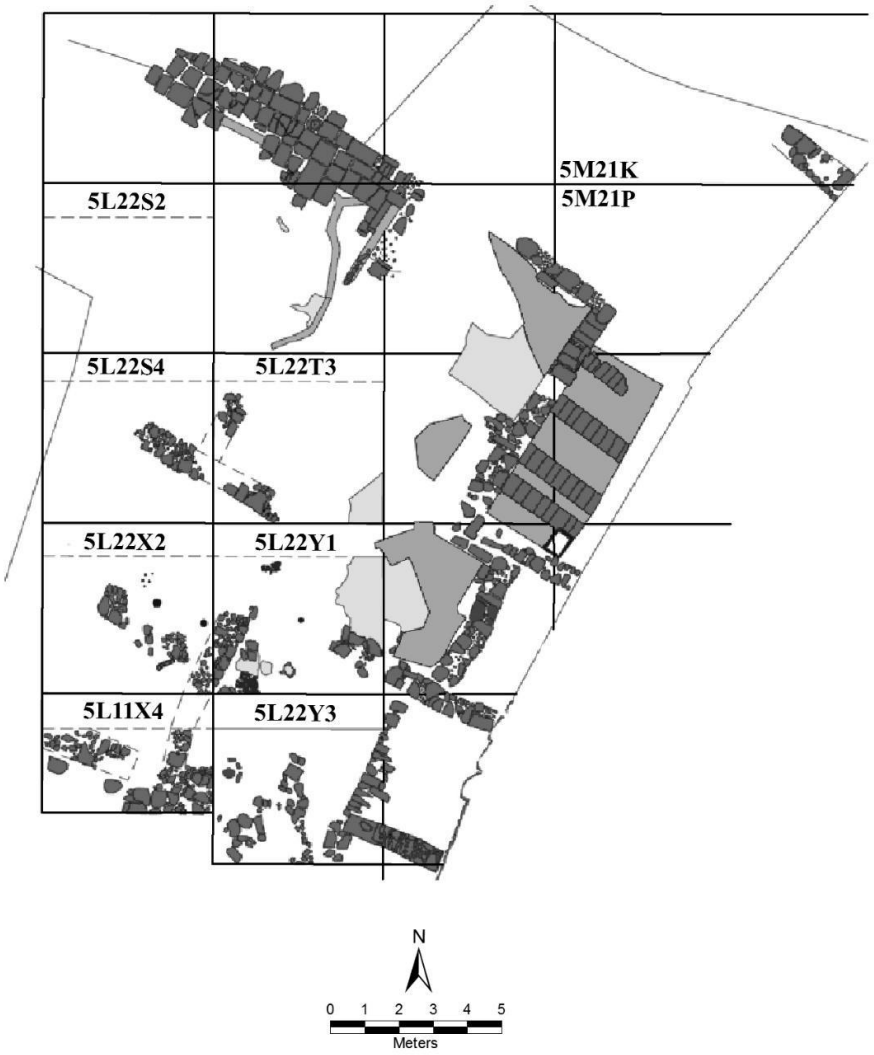

Figure7.18. Architectural units from the Late Byzantine/Early Islamic period in Field C

5L22X2, 5L22X4, 5L22Y1, and 5L22Y3. Most likely these walls served to level the bedrock in this particular area of the complex. A second story paved floor was uncovered that sealed against the pre-classical fortification wall along the eastern edge bordered by walls on its northern and western sides. It appears the southern wall of the room had been destroyed by erosion. Three arches in the room below support the upper floor. The architecture of the lower room was found mostly intact. The floor was hewn out of the local bedrock with a channel cut through the center of the room running roughly north-south. The northern wall contained a window that had been blocked.

Species distribution within the structure was relatively high and consisted of five domestic animals, three wild animals, and one human radius (**Table 7.42**). Although generally MM are the most abundant category represented, sheep and goats are the most abundant animals. Pigs are the third most abundant animals while LM including cattle represent just over 2 % of the overall identified bones. This is an extremely high species diversity suggesting non-domestic activity.

Table7.42. Faunal distribution within the Late Byzantine/Early Islamic architectural unit

Fauna	**Number**	**%**
SHEEP/GOAT	33	6.8%
SHEEP	5	1.0%
GOAT	2	0.4%
CATTLE	2	0.4%
DEER	1	0.2%
EQUUS	1	0.2%
BIRD	1	0.2%
SM	2	0.4%
MM	412	84.9%
LM	9	1.9%
PIG	15	3.1%
FISH	1	0.2%
HU	1	0.2%
Total	**485**	**100.0%**

Only limited MM carcass parts were being utilized in the structure (**Table 7.43**). Axial fragments make up 69.9% of the sample, followed by head at 18.5%. The remaining three categories are represented by less than 7%. Significantly more butcher offal is present. According to Grantham (1992) a high percentage of bones should be reflective of refuse dumps, as to remove odorous waste from domestic units. The higher amount of butchered parts indicates that the animals were being slaughtered away from the structure with the choice cuts being brought in to the area. Only six LM bones could be placed in carcass part categories; four head fragments and one each axial and feet. These distribution patterns are similar to those seen across the site during the Late Byzantine/Early Islamic occupation and indicate that the bones associated with the structure do not reflect domestic activity (Grantham 1992). However, they do reflect an indirect distribution system.

Table7.43. MM carcass part distribution within Late Byzantine/Early Islamic structure

Skeletal Portion	**Number**	**%**
AXIAL	178	65.9%
HEAD	50	18.5%
FORE	14	5.2%
HIND	17	6.3%
FEET	11	4.1%
Total	***270***	**100.0%**
Butcher	***209***	***77.4%***
Slaughter	***61***	***22.6%***

Regional Comparisons

Regional comparisons for the Late Byzantine/Early Islamic occupations are based on sites that represent each of those periods (**Appendices A** and **B**). Sheep and goats

continue to be represented in higher percentages at Tell Madaba than elsewhere in the region. However, Hesban produced only slightly less sheep/goats than Tell Madaba. This is interesting since the two sites are in close proximity, and both are located in the highlands of Jordan. Tell Madaba produced a slightly higher percentage of sheep than goats, while Hesban produced a higher percentage of goats. Cattle continue to be under-represented at Tell Madaba with only 3%, by far the lowest percentage seen in Late Byzantine/Early Islamic Sites. Pig is represented by 9% of the sample, the third highest during the period. Once again, the large abundance of pig may be a direct result of the large Byzantine population still present at the site. *Equus*, camel, and wild game are all represented at Tell Madaba in similar percentages to those seen at most sites across the region. However, Bet She'an contained 46% *Equus* and Elat-Elot contained 22% camel. These are extremely rare percentages for the time period.

Animal Production and Distribution System During the Ottoman Period

All of the faunal remains recovered from the Ottoman occupation were associated with the limited architectural units in Field B. The Ottoman occupation produced a north-south running arched wall line along the crest of the tell within Squares 5M21U4, 5M11A1, 5M11A2, and 5M11A3; a stone-lined bin, segments of stone pavements, and several large ash-filled trash pits (**Figure 7.19**). Based on the excavations, it is thought that during this construction phase much of the tell was removed down to Early Roman/Nabataean deposits. At this time there is no interpretation of the function of this architectural phase.

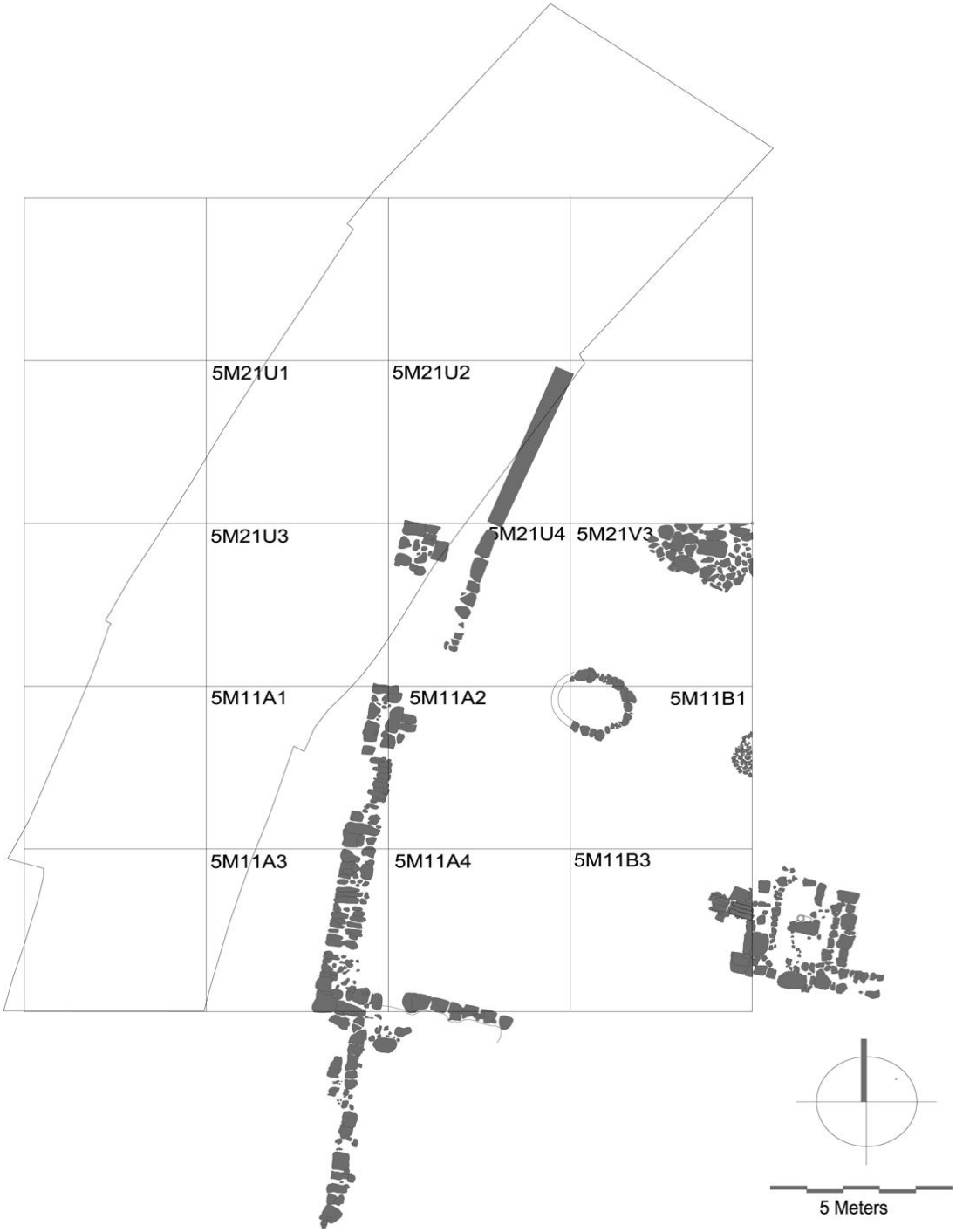

Figure7.19. Architectural unit from the Ottoman occupation

This phase produced the smallest sample of animal bones at Tell Madaba with only 90 identified bones; 22 identifiable bones, 48 LBSF and ribs, and 24 unidentifiable bones (**Table 7.44**). However, a few inferences can be suggested. First it appears that sheep and goats are the most common animals followed by birds. Cattle may have been the third most abundant animal if the LM category is taken into account. The six bones are from medium sized bird and may be chicken. The small number of bones and identified species within the structure is reflective of domestic activity.

Table7.44. Faunal distributions during the Ottoman Period

Fauna	**Number**	**%**
SHEEP/GOAT	16	76.2%
BIRD	3	14.3%
SHEEP	1	4.8%
CATTLE	1	4.8%
Total	**21**	**100.0%**
MM	*42*	**60.0%*
LM	*6*	**8.0%*
SM	*1*	**4.5%*
**represents percentage of total sample*		

Based on MM carcass part distributions there is significantly more butchered parts present in the sample (**Table 7.45**). The higher amount of butchered parts indicates that animals were being processed away the area and the more valued parts were being utilized. Only six LM were associated with the Ottoman structure, and only three of which were assigned to carcass part categories: two axial fragments and one forelimb. This also points to domestic activity. Furthermore, the occupants here probably relied heavily on sheep and goats while utilizing chicken to some degree.

Table7.45. MM carcass part distributions within the Ottoman structure		
Skeletal Portion	**Number**	**%**
AXIAL	15	48.4%
HEAD	5	16.1%
FORE	5	16.1%
HIND	4	12.9%
FEET	2	6.5%
Total	**31**	**100.0%**
Butcher	***24***	***77.4%***
Slaughter	***7***	***22.6%***

Intra-Site Comparisons of Occupational Phases

The analysis above has focused on the animal production system throughout each separate occupational phase represented from the 1996 through 2002 excavations. This section focuses on comparing the animal production system through time and space at Tell Madaba. The previous results illustrated slight shifts throughout time that may have been a direct result of adaptive strategies associated with the various occupations due to the geo-political clime of the region. The results of the intra-site comparison also include spatial information for Fields A and B. In order to conduct this analysis the same methods for abundances used earlier in this dissertation were applied. Abundances were compared using the three statistical measures: TNF, MNI, and RF, while carcass parts distributions were compared using the Archaeological Animal.

Sheep/Goat:Cattle Comparison

All of the sheep/goat, sheep and goat bones were combined and compared to the cattle bones and their ratios compared throughout each of the time periods, except for the Ottoman period which produced too few bones to include in the analysis. The results of these comparisons are shown in Table 7.46. Once again, actual counts are presented as percentages. Relative abundance of Sheep/Goat and cattle illustrates slight differences

according to the three statistical methods. There is a very weak tendency for cattle to be more important during the EBA than the IRII, however it is not significant. It may however, indicate that following the LBA and especially by the IRII, Tell Madaba was significantly removed from the agricultural fields where cattle would have been prevalent. There is a tendency for Sheep/Goat to decrease slightly while cattle increased during the Late Hellenistic occupations, possibly due to an increase in agricultural activities. During the Early Roman/Nabataean occupation, cattle decrease again to levels seen prior to the Late Hellenistic.

Table7.46. Relative abundance (%) of Sheep/Goat and cattle during each time period

	Sheep/Goat			**Cattle**		
Occupational Phase	**TNF**	**MNI**	**RF**	**TNF**	**MNI**	**RF**
EBA	96	98	92	4	2	4
IRII	93	95	91	7	5	9
Hellenistic	97	89	91	3	11	9
Early Roman/Nabataean	95	97	97	5	3	3
Byzantine	99	75	80	1	25	20
Late Byzantine/Early Islamic	97	78	84	3	22	16

The abundance of Sheep/Goat tends to decrease significantly during the Byzantine and Late Byzantine/Early Islamic occupations while cattle increase. Regardless, based on all three statistical measures, sheep and goats were being utilized to a much greater extent than cattle. The slight increase in cattle during the Hellenistic period is probably a reflection of subtle shifts in the animal production system, whereas the occupants were adapting to an increase in agriculture relying on cattle more so than in the preceding period.

Sheep:Goat Comparison

Relative abundance of sheep was compared to that of goats throughout each occupational phase that yielded a large enough sample. The Byzantine and Ottoman occupations produced too few sheep and goat bones to use in this comparison. **Table 7.47** lists the results for this comparison.

Table7.47. Relative abundance (%) of Sheep and Goats

	Sheep			Goats		
Occupational Phase	**TNF**	**MNI**	**RF**	**TNF**	**MNI**	**RF**
EBA	74	83	75	26	17	25
IRII	70	75	79	30	25	21
Hellenistic	45	57	53	55	43	47
Early Roman/Nabataean	51	58	47	49	42	53
Late Byzantine	53	50	57	47	50	43

Relative abundance based on each statistical measure estimates that sheep were utilized to a greater extent than goats during each of the time periods represented. Goats increase in importance significantly during the Late Hellenistic and Early Roman/Nabataean occupations compared to the other periods. This may suggest that during the Hellenistic Period the animal production system at Tell Madaba shifted into a meat and by-product industry, whereas, goats became an important commodity to supply the site with meat and secondary products during the building efforts of the time. It is also likely that during the Late Hellenistic and Early Roman Byzantine periods Madaba was providing animals to other sites in the region, hence the greater abundance of goats. By the Late Byzantine/Early Islamic period, sheep and goats were being utilized almost equally.

The slight shifts observed in the animal production system can be a direct result of adaptive strategies used by the occupants during significant geo-political change and resettlement periods, where goats are more suited for harsh environments and valued for their by-products. Sheep continued to contribute in the animal production system, however, they are not nearly as abundant. This situation would have affected the consumer's choices based on the herder's production goals. It is obvious significant changes altered the interaction of the producers and consumers during two time periods.

Relative Abundance of the Main Domestic Animals

In an effort to determine the importance of the main animals present, all of the sheep and goat bones were combined with the sheep/goat bones and compared to the cattle and pig bones for each time period across the site (**Table 7.48**).

Table7.48. Relative abundance (%) of the three main domestic taxa

Occupational Phase	Sheep/Goat			Cattle			Pig		
	TNF	MNI	RF	TNF	MNI	RF	TNF	MNI	RF
EBA	96	98	96	4	2	4	0	0	0
IAII	94	92	91	5	5	4	1	3	4
Hell	93	84	67	5	11	17	2	5	16
ER	97	95	92	2	3	6	1	2	1
BYZ	95	60	40	1	20	40	4	20	20
LBYZ	89	67	44	3	11	33	8	22	22
OTTO	94	50	67	6	50	33	0	0	0

All three statistical measures estimate that sheep/goat remains are almost always the most abundant domestic fauna. Cattle played a larger role in the animal economies during the EBA, Hellenistic, Byzantine, Late Byzantine/Early Islamic, and the Ottoman periods. Although pig is absent during the EBA and the Ottoman periods, they increase significantly from the IRII through the Late Byzantine/Early Islamic periods, except during the Early Roman/Early Islamic periods. Pig appears to have been utilized more

during the Late Byzantine/Early Islamic period just prior to disappearing completely during the Ottoman. This is not surprising due to the prohibition of pork in Islamic cultures. There is a tendency for cattle to be less important during the IRII than the preceding EBA and the succeeding Late Hellenistic periods. Cattle probably reached over 20 % during the Byzantine and early Islamic periods. This coincides with a decrease in sheep and and goats during both periods.

From these results it can be ascertained that during each of the occupational phases the inhabitants at Tell Madaba relied more heavily on sheep and goats than cattle and pigs, yet there are slight anomalies in the measure that may suggest changes in the agricultural economy at Tell Madaba over time. Cattle peak during the Ottoman period at the expense of pigs and a decrease in the importance of sheep and goats. Also, there was a decrease in the importance of sheep during this period. There was a major resettlement of Tell Madaba during the Ottoman period when numerous families from Kerak settled in the area. Following this resettlement, the occupants probably adapted to agriculture as a means to supply the food system. This would have been supplemented by goats and cows for by-products and some meat. Although small in numbers, sheep would also have been used as a food source.

MM Carcass Part Distributions

All of the MM bones were combined with the sheep/goat, sheep, and goat bones to compare the distribution of carcass parts at Tell Madaba across time. Chi-square analysis was performed to identify shifts in direction in the way carcasses were being

discard between the occupational phases (**Table7.49**). Axial fragments are the most abundant category during each period. The Late Byzantine/Early Islamic occupation produced the highest percentage of axial bones, while the Late EBA produced the lowest percentage. For the most part, axial bones represent close to 50% or more of the archaeological animal throughout most of the occupational phases. Feet and hind limbs are the least represented categories. However, if the forelimbs and hind limbs are combined, feet are the least represented category. Feet peak during the Ottoman period at 6.5%. The EBA produced the highest percentage of head fragments with 33.5%. Between the IRII and the Early Roman period, head fragments ranged between 17.8% and 19.4%. For the most part, head fragments are more abundant than hind or limb bones throughout each occupational phase except the Ottoman period. Based on this data, there is a significant increase in Axial remains following the EBA into the IRII and into the Late Byzantine period. Following that, there is a sharp decrease during the Ottoman period.

The carcass parts of MM were placed into groups based on the stage of discard they represent for each occupational phase. There is significantly more butchered than slaughtered parts present throughout each occupational phase (**Figure 7.20**). The EBA produced the highest abundance of slaughtered parts in contrast to butchered parts. During the

Number Row % Col % Total %	**Table7.49.** MM carcass part distributions over time					
	AXIAL	**HEAD**	**FORE**	**HIND**	**FEET**	**Totals**
EBA	220	203	76	73	34	
	36.30%	33.50%	12.50%	12.00%	5.60%	606
	2.40%	6.80%	3.90%	4.20%	4.90%	3.70%
	1.30%	1.20%	0.50%	0.40%	0.20%	
	0.50%	0.10%	0.10%	0.10%	0.10%	
IRII	3,382	1,122	794	769	251	
	53.50%	17.80%	12.60%	12.20%	4.00%	6,318
	37.30%	37.40%	40.70%	44.20%	36.00%	38.40%
	20.60%	6.80%	4.80%	4.70%	1.50%	
HELLENISTIC	55.30%	19.40%	11.80%	9.20%	4.30%	1,597
	9.70%	10.30%	9.70%	8.50%	9.70%	9.70%
	5.40%	1.90%	1.10%	0.90%	0.40%	
EARLY ROMAN	3,679	1,184	783	656	269	
	56.00%	18.00%	11.90%	10.00%	4.10%	6,571
	40.50%	39.50%	40.20%	37.70%	38.50%	39.90%
	22.40%	7.20%	4.80%	4.00%	1.60%	
LATE BYZANTINE/ EARLY ISLAMIC	817	151	92	70	65	
	68.40%	12.60%	7.70%	5.90%	5.40%	1,195
	9.00%	5.00%	4.70%	4.00%	9.30%	7.30%
	5.00%	0.90%	0.60%	0.40%	0.40%	
OTTOMAN	15	5	5	4	2	
	48.40%	16.10%	16.10%	12.90%	6.50%	31
	0.20%	0.20%	0.30%	0.20%	0.30%	0.20%
	0.10%	0.00%	0.00%	0.00%	0.00%	
Totals	**9,075**	**2,996**	**1,949**	**1,738**	**698**	**16,456**
	55.10%	**18.20%**	**11.80%**	**10.60%**	**4.20%**	**100.00%**

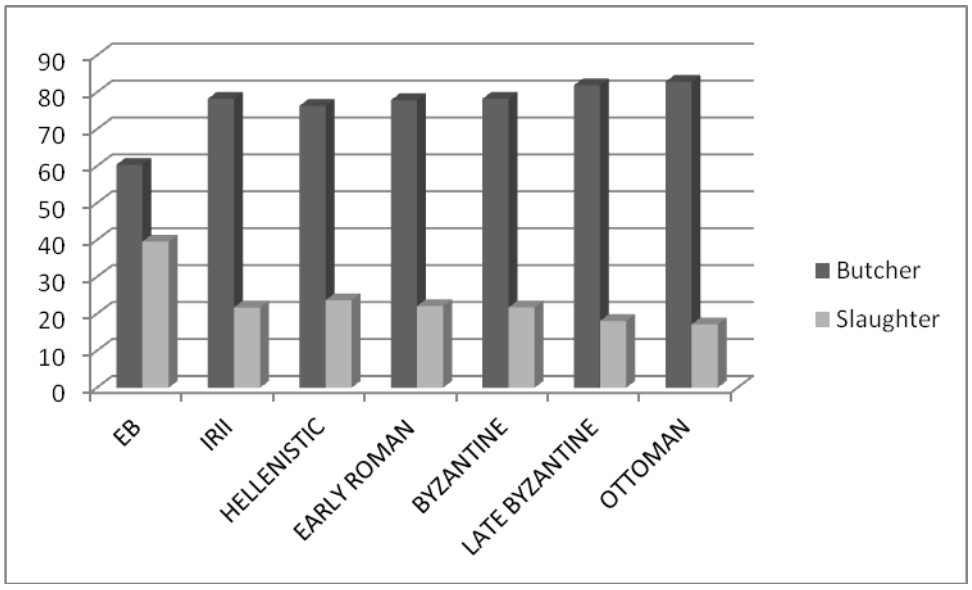

Figure7.20. MM carcass part distribution patterns

IRII there is a significant increase in the abundance of butchered parts with a slight decrease during the Late Hellenistic Period. Following the Hellenistic period, there is a tendency for slight increases in slaughtered parts. Although small, these shifts indicate subtle changes in the animal production and consumption system over time.

During the EBA the occupants had more access to entire MM carcasses. This, coupled with the harvest profiles above, suggests that the animal production system during the EBA was probably two-fold, supplying meat and by-products. More sheep and goats were being raised near the city proper during this period than the later periods. This is related to changes in settlement patterns beginning during the IRII and continuing over time. During the IRII, Madaba had regained its urban identity and probably continued to grow and flourish. Therefore, adaptive strategies altered the complexity of the animal production system allowing for more separation in the production and distribution

system. As the site grew the animal production system became more segregated from the city proper, and as a result the inhabitants had access to the more desired carcass parts. Hence, the local producers had to adapt to meet consumer market demands. The slight increase in slaughter offal during the Hellenistic period is a direct result of more access to whole carcasses, thus, MMs were more closely herded to the city. The ratios between slaughter and butcher offal during the Early Roman/Nabataean and Byzantine periods stayed consistent. Slaughter parts decreased significantly during the Late Byzantine/Early Islamic and the Ottoman occupations.

These shifts are an indication that the animal production system was affected by the changing settlement, social, and geo-political climate for those occupational phases. As urban society became more complex during the IRII, there was a slight shift in the animal production system and more segregation occurred between the producers and consumers than previously during the EBA. The slight increase in slaughter offal during the Late Hellenistic Period is indicative that the animal production system may have shifted as a result of the limited interest in the region possibly affecting population size or construction efforts to build the city. This would have shifted the animal production system from segregated to more closely herded animals, providing the inhabitants more access to whole MM carcasses.

LM Carcass Part Distribution over Time

LM carcass parts distributed throughout the occupational phases at Tell Madaba presents contrasting results from those observed within the MM sample. **Table 7.50** lists

Number **Row %** **Col %** **Total %**	**Table7.50.** LM carcass part distributions over time					
	AXIAL	**HEAD**	**FORE**	**HIND**	**FEET**	**Totals**
	3	5	6	1	2	
LATE EB I/II	17.60%	29.40%	35.30%	5.90%	11.80%	17
	1.40%	3.20%	7.10%	0.90%	2.70%	2.70%
	0.50%	0.80%	0.90%	0.20%	0.30%	
IRON II	85	66	32	54	43	
	30.40%	23.60%	11.40%	19.30%	15.40%	280
	39.90%	42.60%	38.10%	50.50%	58.10%	44.20%
	13.40%	10.40%	5.10%	8.50%	6.80%	
HELLENISTIC	28	33	11	9	7	
	31.80%	37.50%	12.50%	10.20%	8.00%	88
	13.10%	21.30%	13.10%	8.40%	9.50%	13.90%
	4.40%	5.20%	1.70%	1.40%	1.10%	
EARLY ROMAN	90	28	32	38	15	
	44.30%	13.80%	15.80%	18.70%	7.40%	203
	42.30%	18.10%	38.10%	35.50%	20.30%	32.10%
	14.20%	4.40%	5.10%	6.00%	2.40%	
BYZANTINE	0	0	0	0	1	
	0.00%	0.00%	0.00%	0.00%	100.00%	1
	0.00%	0.00%	0.00%	0.00%	1.40%	0.20%
	0.00%	0.00%	0.00%	0.00%	0.20%	
LATE BYZANTINE	5	23	2	5	6	
	12.20%	56.10%	4.90%	12.20%	14.60%	41
	2.30%	14.80%	2.40%	4.70%	8.10%	6.50%
	0.80%	3.60%	0.30%	0.80%	0.90%	
OTTOMAN	2	0	1	0	0	
	66.70%	0.00%	33.30%	0.00%	0.00%	3
	0.90%	0.00%	1.20%	0.00%	0.00%	0.50%
	0.30%	0.00%	0.20%	0.00%	0.00%	
Totals	**213**	**155**	**84**	**107**	**74**	**633**
	33.60%	**24.50%**	**13.30%**	**16.90%**	**11.70%**	**100.00%**

the distribution of carcass parts for each occupation. Axial fragments are most abundant during the Early Roman/Nabataean occupation, while they are least represented during the Late Byzantine/Early Islamic occupation. Head fragments reach 56% during the Late Byzantine/Early Islamic occupation, and are represented by less than 14 % during the Early Roman/Nabataean occupation. Other than the Early Roman/Nabataean occupation, head is represented in large abundances for those occupational phases that produced enough LM bones to analyze.

The LM carcass parts for each occupational phase were placed into groups based on the stage of discard they represent (**Figure 7.21**). The Byzantine and Ottoman periods did not produce enough identifiable LM bones to use in this analysis. During the first three occupational phases, a high percentage of slaughter parts was present at the site, which peaked at over 40% during the Hellenistic period. Furthermore, there is a slight decrease in slaughter parts between the EBA and the IRII, followed by a significant increase in slaughter offal during the Late Hellenistic occupation. During the following Early Roman/Nabataean occupation, there is a sharp decrease in the percentage of slaughter parts which continues into the Late Byzantine period.

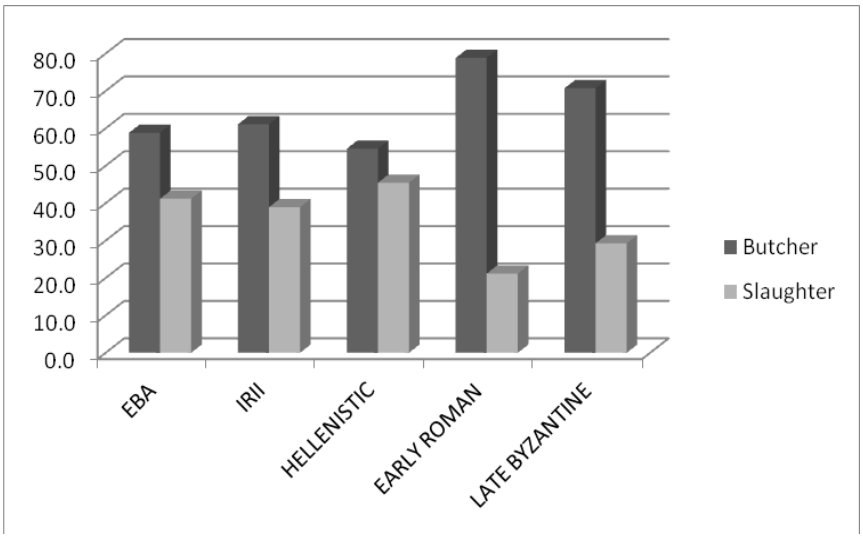

Figure7.21. LM carcass part pattern distributions

Based on these patterns, the occupants had more access to whole LM carcasses during the EBA through the Late Hellenistic period than the later periods. This shift suggests that during the first three occupations, only a small amount of cattle were being raised close to the city proper for draft and labor purposes. At no time during the earlier three occupations did cattle reach percentages that suggest they were part of an intensified agricultural society; although cattle may have represented over 10% of the main animals during the Late Hellenistic Period. More than likely, during the earlier three occupations, small scale agriculture was located near the site, and the occupants may have supplemented their diet with cattle. During the Early Roman/Nabataean occupation cattle became more segregated away from the site. These patterns do not, however, suggest that cattle played a major role in the diets of the occupants at Tell Madaba.

In order to determine if occupants in different areas of the site were utilizing animals differently during the IRII, the main domestic animals were compared between

Fields A and B (**Table 7.51**). Based on all three statistical measures, there is a much higher percentage of cattle in Field A. This may be a reflection that Field A was near agricultural fields that helped sustain the site during the IRII. Furthermore, Field B contained a much higher percentage of goats compared to sheep. These results suggest that the occupants in Field B relied heavily on sheep and maintained a substantial amount of goats, while Field A was less reliant on goats as a food source. These differences may be associated with locality more so than preference. Field A appears to have been closer to agricultural fields, thereby maintaining more cattle. Field B may have been closer to the open herding grounds where pastoralists maintained both sheep and goats as a means of meat and secondary products.

Excavation Field	**Table7.51.** Relative abundance (%) of sheep, goats, and cattle during the IRII in Fields A and B					
	Sheep/Goat			**Cattle**		
	TNF	*MNI*	*RF*	*TNF*	*MNI*	*RF*
Field A	89	87	85	11	13	15
Field B	95	95	97	5	5	3
	Sheep			**Goats**		
	TNF	*MNI*	*RF*	*TNF*	*MNI*	*RF*
Field A	86	90	88	14	10	12
Field B	61	65	69	39	35	31

Based on carcass part distributions during the IRII, occupants in Field A produced a higher percentage of MM head and toe fragments than Field B (**Table 7.52**). This correlates with a much higher percentage of axial fragments in Field B. Both fore and hind limbs are represented in higher percentages in Field A. When carcass parts are placed into groups based on stages of discard, each area produced significantly higher proportions of butchered parts (**Figure 7.22**). Field A produced slightly higher percentages of slaughter parts, suggesting that the IRII occupants had varying degrees of

access to

Table7.52. MM carcass part distribution during the IRII			
Number Row % Col % Total %	**FIELD A**	**FIELD B**	**TOTAL**
AXIAL	428	3076	
	12.20%	87.80%	3504
	41.50%	53.90%	52.00%
	6.40%	45.70%	
HEAD	231	997	
	18.80%	81.20%	1228
	22.40%	17.50%	18.20%
	3.40%	14.80%	
FORE	151	696	
	17.80%	82.20%	847
	14.60%	12.20%	12.60%
	2.20%	10.30%	
HIND	143	711	
	16.70%	83.30%	854
	13.90%	12.50%	12.70%
	2.10%	10.60%	
FEET	78	222	
	26.00%	74.00%	300
	7.60%	3.90%	4.50%
	1.20%	3.30%	
Totals	1031	5702	6733
	15.30%	84.70%	100.00%
Chi-Square = 69.43 Degrees Of Freedom = 4 Probability Of Chance =0.000			

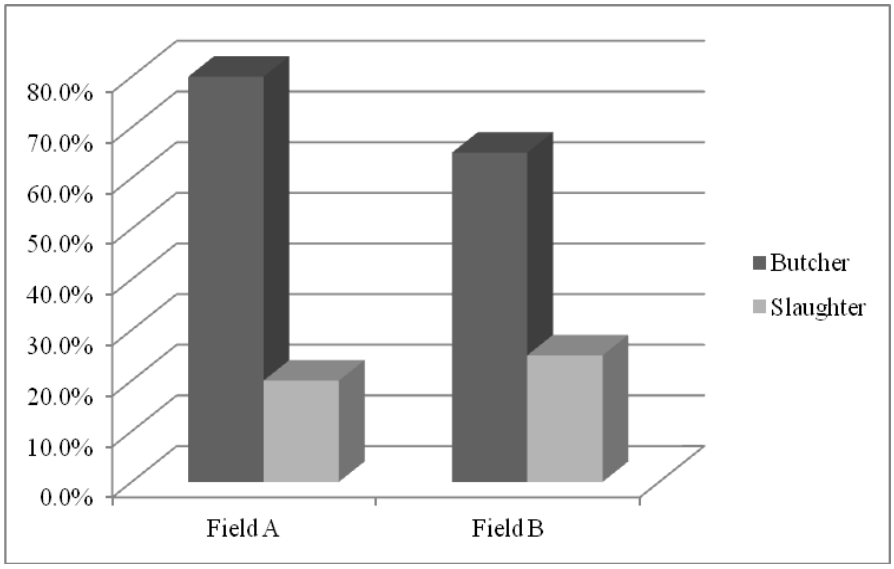

Figure7.22. MM carcass part distributions

whole MM carcasses. Field A had a less segregated animal distribution system that allowed more slaughter parts to be discarded in the area. These contrasts can be interpreted as social and spatial differentiation within the slaughter-butcher-distribution system. In other words, during the IRII, occupants in Field A had more direct access to MM carcasses while those in Field B were provided the more desirable cuts, probably through a redistribution market system.

LM carcass part distributions in Fields A and B show significant differences. **Table 7.53** lists the distribution of each carcass part within the two fields. Field A produced an extremely high percentage of head and feet fragments. Axial fragments and limb bones are slightly disproportionately distributed in Field B. When carcass parts are placed into the stage of discard they represent, significant differences are observed between Fields A and B. **Figure 7.23** shows the distribution of carcass parts for both fields. Field A produced a nearly equal distribution of slaughtere and butcher offal.

Table7.53. LM carcass parts during the IRII			
Number Row % Col % Total %	**FIELD A**	**FIELD B**	**Totals**
AXIAL	17	66	
	20.5%	79.5%	83
	19.3%	34.7%	29.9%
	6.1%	23.7%	
HEAD	26	40	
	39.4%	60.6%	66
	29.5%	21.1%	23.7%
	9.4%	14.4%	
FORE	12	20	
	37.5%	62.5%	32
	13.6%	10.5%	11.5%
	4.3%	7.2%	
HIND	14	40	
	25.9%	74.1%	54
	15.9%	21.1%	19.4%
	5.0%	14.4%	
FEET	19	24	
	44.2%	55.8%	43
	21.6%	12.6%	15.5%
	6.8%	8.6%	
Totals	88	190	278
	31.7%	68.3%	100.0%
Chi-Square = 11.06 Valid Cases = 278 Degrees Of Freedom = 4 Missing Cases = 102 Probability Of Chance =0.026			

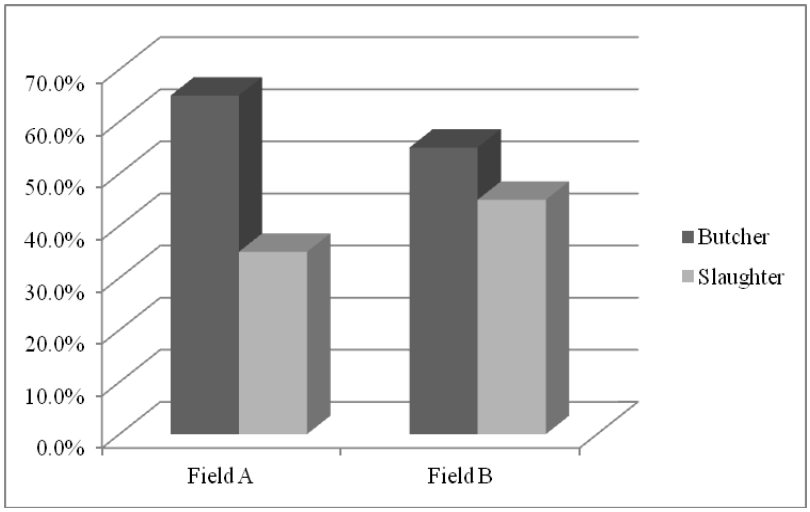

Figure 7.23. LM carcass part distributions

Field B produced a high percentage of slaughter offal, but yielded a higher percentage of butchered parts. These results strongly suggest that occupants in both fields had more access to whole LM carcasses. However, the occupants of Field A certainly had more access to

entire LM carcasses. These results suggest that Field A was more closely tied to near-by small-scale agricultural fields during the IRII than Field B. The occupants of Field A probably maintained herds of cattle to use as draft animals, slaughtering them once they reached the end of their use-life.

CHAPTER 8

PIGS AND ETHNICITY IN NEAR EASTERN CONTEXTS AT TELL MADABA

The presence/absence and consumption of pig has been at the forefront of major historical and archaeological debates in the Near East. The pig consumption issue arises from their position at the top of the list of prohibited animals among various religious groups throughout the region (Harris 1985; Hesse 1986, 1990; Sapir-Hen 2013). After Hesse (1986) published the correlation between pig use and Philistine occupations at Tel Miqne-Ekron, the use or non-use of the animal has come to symbolize an ethnic marker. It has since become common to identify Israelite and Philistine occupations along the frontiers of these geo-political entities simply from baseline material culture and the presence or absence of pigs. Furthermore, it has also become common for archaeologists to attempt to identify ethnicity based on the presence or absence of pigs from archaeological sites far away from the Israelite-Philistia borders, including Trans-Jordan. This is unfortunate since Hesse (among other Middle Eastern archaeologists) reject this approach. The problem is two-fold, the first being the actual definitions assigned to the terms ethnicity and identity, and the second is the question of equifinality (Hesse 1990). Although an in-depth study of the association between pigs and ethnicity at Tell Madaba is far beyond the scope of this dissertation, several issues need to be addressed in order to place this topic in proper context within the faunal sample studied.

Numerous scholars have offered revisions of the concept of ethnicity as it is interpreted from the archaeological record (Hesse 1990; Hesse and Wapnish 1997, 1999; Graves-Brown et al. 1996). Recently, the definition of ethnicity has incoporated three topics that emphasize boundary and hierarchy, strategy and contingency, and ontology and values (Hesse and Wapnish 1997). These concepts provide a realm for archaeologists to restructure the way social meaning is interpreted from material remains. Two examples of ethnic identity in the archaeological record are the association of pigs with Philistines and the avoidance of the animal by the Israelites; two competing political entities of Judah and Philistia.

The term ethnicity has become so distorted its definitional criteria has been challenged (Hesse 1995). One major concern is equifinality, or the number of cultural processes that can influence the use or non-use of pigs (Hesse and Wapnish 1997; Grigson 1995; Crabtree 1989; and Redding 1993; among others). It also seems relevant to suggest that there are numerous natural processes that can lead to the presence or absence of certain animal remains recovered from archaeological deposits (Lyman 1994). In the past, archaeologists utilized the term ethnicity to refer to some type of social identity (Lev-Tov 2000; Hesse and Wapnish 2001; Stager 1995; Graves-Brown. Et al. 1996). According to Hesse (1995), when assessing ethnicity or social identity within the archaeological record we must determine between a series of different criteria:

> ancient peoples recognized the "ethnicity" assigned to them (an emic identity) or only modern researchers can recognize the quality (an etic identity).
>
> people assigned an "ethnicity" occupied a clearly delimited territory (a locational identity) or, conversely, were scattered and interwoven with other identities in a social mosaic of no particular spatial configuration.

people construct an "ethnicity" from an internal expression of cultural tradition (an essential identity) or produce it as a byproduct of social interaction (a boundary identity).

"ethnicity" always implies some kind of political or economic domination of one group by another, or can occur in the absence of social stratification.

whether "ethnicity" is a property of people rather than a quality of things.

Failure to distinguish between these criteria has led to the concept of ethnicity being used as a type of synonym for culture, tradition, or social identity (Hesse and Wapnish 1997). This has generated the unfortunate circumstance of making it difficult to distinguish the difference between ethnicity and terms such as "nation and nationalism" (Hesse and Wapnish 1999). The concept of ethnicity has long been used by archaeologists to define groups solely on their material or behavioral content (Faust and Lev-Tov 2012). Labeling ethnicity based on material and behavioral content creates a social reality separate from the observer's ideas, but inseparable from the categories (Hesse and Wapnish 1997; Lev-Tov 2000). Recently, criticism of the rigid nature of this approach has developed within the archaeological community (Grantham 1992 and 1996; Hesse and Wapnish 1997, 1999, and 2001; Lev-Tov 2000, among others). Another major criticism of this approach is the difficulty in distinguishing complex multi-cultural systems because it stresses locational aspects of social identity (Hesse and Wapnish 1997).

A significant amount of archaeological research in the Levant has focused on the search for the origins of the ancient Israelites (Wapnish 1993). It has become more common to regard this as a search for an Israelite Ethnicity and not social identity with such terms as "tribe, culture, or nation" (Stager 1995; Wapnish 1993). This shift is

primarily based on the assumption that the term ethnicity contains deep meanings of self-awareness (Hesse and Wapnish 1997). Unfortunately, many archaeologists do not recognize a problem in the relationship between the distributions of cultural material they discover and the meanings they understand to be associated with those items (Wapnish 1993). As Griffith and Hesse (1999:6) state, the easiest path around the argument of the presence of pig is to label the cultural affiliation as Philistine; however, several other factors must be taken into account. Cultural and natural processes must be considered when accounting for the presence or absence of pig remains at archaeological sites. Hesse and Wapnish (1999:128) have presented several "pig principlae" that can affect the use or non-use of pigs and are listed below:

> **I. Wet or Dry**
>
> The successful husbandry of pigs demands water in amounts greater than that required by other barnyard stock. Annual rainfall levels of approximately 300-350 mm may be required unless substantial infra structural investments are made.
>
> **II. Sedentary or Mobile**
>
> Pigs are hard to herd though not impossible, as the use of drover pigs to support DeSoto's 16th century expedition through the American Southwest clearly shows. The question is largely: how much labor will the group be willing to devote to this part of the pastoral effort? The answer is usually so low that the adoption of pig husbandry serves to break any nomadic or migratory aspirations held by a human society.
>
> **III. Recyclers or Pests**
>
> The enthusiasm pigs have for human waste products found at human habitations can be channeled into creating a low cost urban husbandry as well as sanitation service. On the other hand the amount of plant waste that different agricultural regimes yield varies greatly and not all of it is suitable as pig fodder. Moreover, pigs can be quite destructive in their search for food. So the attractiveness and viability of casual swine management in a city or town is not certain, but rather conditioned by the agropastoral system which engulfs it and the architecture of the settlement which it is practiced.

IV. Initial Strategy or Mature System

The rapid reproduction rates of pigs makes swine husbandry attractive to immigrants who are creating a new agro-pastoral settlements in their adopted land. This advantage gradually is lost as the economy matures and the stock of animals more capable of generating secondary products rises. At that point cattle, sheep, and goats become more common. This model actually combines elements of two of the following pig principles: nos. V and VII

V. Low Intensity or High Intensity Agriculture

Pork production found in ancient Egypt suggested that the intensification of grain production was accompanied by the shift from a sheep/pig husbandry to one focused on cattle and goats, a transformation required by the changes in land use demanded by the new system.

VI. High Intensity Agriculture or Carnivorous Pastoralism

When the preference for meat as source of food rises to a sufficiently high level, the market reward encourages specialized carnivorous pastoralism, even given the inefficiencies of this mode of production compared to those focused on dairy products or fiber. At some price threshold pigs can reenter the ago-pastoral system since the profit margin associated with meat then exceeds the value assigned the secondary products available from the bovids. It is no accident that chickens and pigs both species capable of high meat yields, enter the urban market in the southern Levant together during the economic and demographic boom of the Hellenistic and Roman periods.

VII. Independence or Centralization

Pigs rapidly produce much protein. However in technologically simple systems, the energy of swine yield is not easily transported to market or captured by tributary systems. These facts have led to the idea that pig husbandry is a useful rural subsistence strategy, one that permits satellite communities to emphasize their domestic non-,market based modes of production and in doing so maintain a degree of independence from those centers in the political economy which seek to control them.

VIII. High Class or Low Class

The use of swine in ancient Egypt illustrates that both the production and consumption of pork was associated with the lower or working class status both in the textual record and in samples of the archaeological remains. This association appears to be duplicated in Mesopotamia texts as well.

IX. Ritual or Secular

The non-use of pigs in the official religious rituals of the ancient Near East have been discussed by many authorities. This conclusion is based mostly on textual evidence and is supported by some (not all) of the archaeological record.

These pig principles can be illustrated from an historical trend in pig use in the Near East that saw a steady decline from the EBA to the Iron Age (Hesse 2001). Only during the Hellenistic occupations did pig exploitation reach levels seen prior to the EBA. There is no clear relationship that ties pig bone abundance or its absence to social identity; however, there are economic, political, social and religious systems of behavior that shaped attitudes toward the pig (Hesse and Wapnish 1997; Zeder 1998).

The concept of ethnicity should require that we look beyond distributions of cultural material and consider the context within which symbolic choices originate (Hesse 1995; Wapnish 1995; Lev-Tov 2000 and 2003; Russel 2012; Sapir-Hen et al. 2013). Connotations associated with ethnicity needs to be reevaluated. We must attempt, as Hodder (1992) and Hesse (1995) illustrate, to understand how material culture, in this case pig, functioned within the archaeological and historical contexts. In turn, it may be possible to understand how this material culture obtains social importance. Numerous particulars can be analyzed from the archaeological record to elucidate the behavioral issues that nurtured the negative or positive associations with pigs. Baseline stamped labels of ethnicity cannot be applied from isolated material attributes. Archaeologists must carefully make use of the entire context of the archaeological record.

Pigs at Tell Madaba

Only 71 pig bones were identified in the Tell Madaba faunal assemblage, thereby limiting a detailed analysis between the association of pigs and ethnicity. Pig is entirely absent from the EBA deposits and appears only in a small amount during the IRII.

Following the IRII, pig increases during the Late Hellenistic Period, only to decline back to similar levels seen in the IRII during the Early Roman/Nabataean occupation. The Byzantine and Late Byzantine/Early Islamic occupations mark the largest increase in pig bones with 3.7 % and 6.4 % of the total animals identified, respectively. This is a significant increase, especially for the Early Islamic period. There were no strict food taboos against eating pig in the Christian religion; however, pig consumption is forbidden within the Islamic traditions. Petter (2014) also postulated that while there may have been groups in Jordan during the Iron Age associated with Yahwistic ideology, for the most part communities in Jordan maintained their own local social identity. Therefore, Tell Madaba probably maintained a major Christian population during this time period. However, at the onset of the Late Islamic Ottoman period, pig completely disappears, a process most likely associated with the Islamic culture.

Although difficult to ascertain ethnic identity based on the limited abundance of pigs during any of the occupation phases at Tell Madaba, it is obvious that a similar trend is seen across the Near East. Pig bones are more prevalent during the Hellenistic, Byzantine, and Late Byzantine periods. However, they are almost non-existent during the EBA and only a few pig remains are present during the IRII. The IRII assemblage is similar to that seen across the rest of the region, with only a handful of sites yielding any significant amount of pig. Recently, Griffith (2001) recorded 6 % pig within IRII deposits at Tel Hamid and Lev-Tov (2012) recorded over 15 % within IRII deposits at Tell es-Safi/Gath; currently these are anomalies for the Near East. Since there's no textual evidence about social identity or ethnicity at Tell Madaba, the presence of pig remains is

probably a direct result of one of Hesse's "Pig Principals" affecting the use and consumption of pork. The absence of pig during the Ottoman period is most likely associated with the Islamic pig taboo, and thus cannot be used as an ethnic marker since the Islamic religion is host to a multitude of ethnic groups. Although the absence of pig during the later Islamic periods can be a signal of social identity, it is not to be confused with ethnicity.

In sum, given Hesse's argument considering the pig principals, the faunal data at Tell Madaba does not, nor can it, shed light on ethnic markers within the archaeological record. It does, however, shed some light on identity, whereby the occupants at Tell Madaba were probably associated with particular social and religious groups, and each group had their own conception of pig use. Pigs were probably consumed during the later periods as a means of necessity because of the limited supply of sheep and goats. Furthermore, given the pig's ability to produce the highest yield of meat per labor and time expended, they are a viable source of protein and are easily replaced through highly managed animal production systems.

CHAPTER 9
SUMMARY AND CONCLUSIONS

This research focused on a large faunal assemblage associated with seven distinct occupational phases at Tell Madaba. Evidence extracted from the analysis provided insight into the animal production system that sustained a large urban site and also revealed adaptations as they pertain to site-specific and regional socio-economic and geo-political issues over time. The archaeology at Tell Madaba presented an excellent opportunity to investigate zooacraheological and anthropological models of economic and social change, and adaptive strategies utilized by ancient occupants across seven historically distinct periods. It also provided an array of comparative data for understanding the cultural, economic, and geo-political climates across the region, providing a rich source for understanding the dynamics of various polities over time and space. Based on the paleoenvironmental studies, ecological changes should not have affected the animal production and distribution system during any of the time periods studied.

Taphonomic analysis suggests that for each occupational phase, the faunal assemblages are more reflective of later stage "archaeological assemblages" described in Chapter 5. These assemblages are a direct result of the socio-cultural processes dictating which animals and carcass parts were utilized throughout time at Tell Madaba. At no time does the faunal assemblage reflect the herd or discard assemblage. Also, the abundance of unidentifiable bone throughout the assemblage suggests that the faunal

remains were significantly affected by post-depositional processes such as trampling and occupational activities.

Each occupational phase can now be categorized by the proper animal production system. Based on the distribution of species, carcass parts, and harvest profiles, Tell Madaba functioned as a regional or local center during each occupational phase. The ratio between the main domestic animals indicates that sheep and goats were utilized to a much greater extent than cattle and pigs. This faunal analysis indicates that Tell Madaba was not controlled by a larger site providing animals by way of tribute during any occupational phase. However, subtle shifts in the animal production system suggest that the occupants were susceptible to adaptive strategies that accommodated changes in population in addition to the social and political climates present during different periods.

The economic importance of agriculture was minor from the EBA through the Late Hellenistic Period, but increased in significance during the succeeding periods. It is likely that agricultural development was strongly controlled by the limited water sources near Tell Madaba. Although numerous water catchment systems were constructed at the site, it was not until the Roman occupation that a large reservoir, the Berka, was built to maintain a more predictable water source.

During the EBA, more urban sites appeared across the Near East, possibly altering the animal production system at Tell Madaba. That system became more complex and was characterized by indirect distribution that kept animals separated from the consumers. The site relied much more heavily on sheep and goats than cattle. Sheep were the most important animal within the economy throughout most occupational

phases, though goats also played a major role. The animal production system also relied on a two-fold system: one for meat and one for secondary by-products as illustrated by the distribution of species and harvest profiles. For the most part, herders were simultaneaously concerned with market demand and herd security that probably reflects a smaller urban site. LM did not play a significant role in the diet of the inhabitants. As is typical for the region, wild game did not factor into the animal production system. Nonetheless, based on faunal data, Tell Madaba probably functioned as a major center during the EBA, perhaps localized and small compared to other periods.

Following the urban collapse across the Southern Levant during the LBA, Tell Madaba grew into an urban entity again by the IRII. The animal production system during the IRII seems to reflect one of a market distribution system where animals were raised and slaughtered away from the site and the choice cuts were distributed to the consumers. Due to the geo-political climate of the region during the Iron Age, Tell Madaba had probably developed into a major regional or local center, or at a minimum, an extremely important urban site, drawing animals and agricultural goods from the surrounding area.

There were only slight shifts in the animal production system between the EBA and the IRII. The most noticeable change was the ratio in slaughtered and butchered parts between the two periods. More slaughtered parts are present in the EBA occupation compared to the IRII. The abundance of slaughtered parts may suggest that the occupants adapted to a more indirect system of animal production during the IRII. The shift in the animal production system from the EBA was probably a result of changes in the regional,

local, social, and political climate in combination with the growing population during the IRII. Producers were probably tasked with providing a much larger population during the IRII; hence the animal production system shifted to meet market and consumer demands. As a society becomes more complex, the animal production and distribution system follows suit and becomes more separated, with more preferred animals delivered to the consumers.

By the Late Hellenistic, following periods of instability and possible abandonment at Tell Madaba, the animal production system shifted and goats increased significantly, becoming more utilized than sheep. This was probably a social and economic adaptation to the movements of smaller populations into the Tell Madaba region following the Persian and early Hellenistic limited populations, in addition to the Nabataeans and Hasmoaeans establishing political control over large areas in the region (Harrison 1996b). Hence, the animal production system focused primarily on secondary products and herd security as the occupants adapted to a smaller population with more insecurity from indirect supplies from outside the area. This trend continued into the Early Roman/Nabataean and Late Byzantine/Early Islamic occupations, although sheep became slightly more abundant. LM also increased during these two occupational phases, providing support for increasing agricultural activity.

During the Early Roman/Nabataean period, a new political establishment was formulated with the vaious provinces, and Madaba continued to see significant growth (Harrison 1996b). The Nabataean occupation allowed for significant economic and political growth, and agricultural activities increased at the site. Additionally, herds for

both food and secondary products were being maintained in order to sustain a rapidly growing population.

Significant growth and prosperity continued into the early Byzantine period, during which Madaba had at least six churches. However, near the latter part of the sixth century, Byzantium began to decrease in size and power as a result of conflicts and natural disasters (Harrison 1996b). The animal production system at Tell Madaba shows significant shifts in the animal production system, reflecting economic adaptive strategies throughout the Byzantine Period. According to the present findings, agricultural activities intensified at Tell Madaba during the Byzantine through the Ottoman occupations as compared to previous occupations. The intensified agriculture reflects the constantly growing population and construction efforts during the Byzantine period and re-settlement efforts during the Ottoman period. Cattle are also highly represented during the Late Hellenistic, which may also be a result of re-settlement efforts. During each of these occupations, sheep and goats are represented in similar proportions, except for the Late Byzantine/Early Islamic. Additionally, during periods of growth or resettlement, the animal production system focused heavily on dairy and secondary products from sheep and goats, while abundant cattle provided needed labor for agricultural fields and building activities.

Pigs did not play a significant role in the animal production system during any occupational phase examined in this study; however, during the Late Hellenistic Period, pigs may have comprised as much as 10% of the main domestic animals, while during the Byzantine and late Byzantine/Early Islamic periods they may have comprised as much as

20%. The abundance of pig associated with these periods is probably related to environmental and social conditions and not ethnicity. However, during the latter two phases there was a significant Byzantine Christian population at Tell Madaba that constituted many different ethnic groups. According to Hesse (1990), the presence versus absence of pigs is more strongly influenced by animal exploitation strategies and environmental conditions rather than social identity or an ethnicity.

This study has demonstrated the utility of zooarchaeology in the analysis of ancient animal economies and human adaptation. In sum, the detailed faunal analysis has shed light on subtle shifts within the ancient animal production systems associated with adaptive strategies undertaken by the producers and consumers to accommodate changing populations and political entities in the semi-arid highlands of Jordan.

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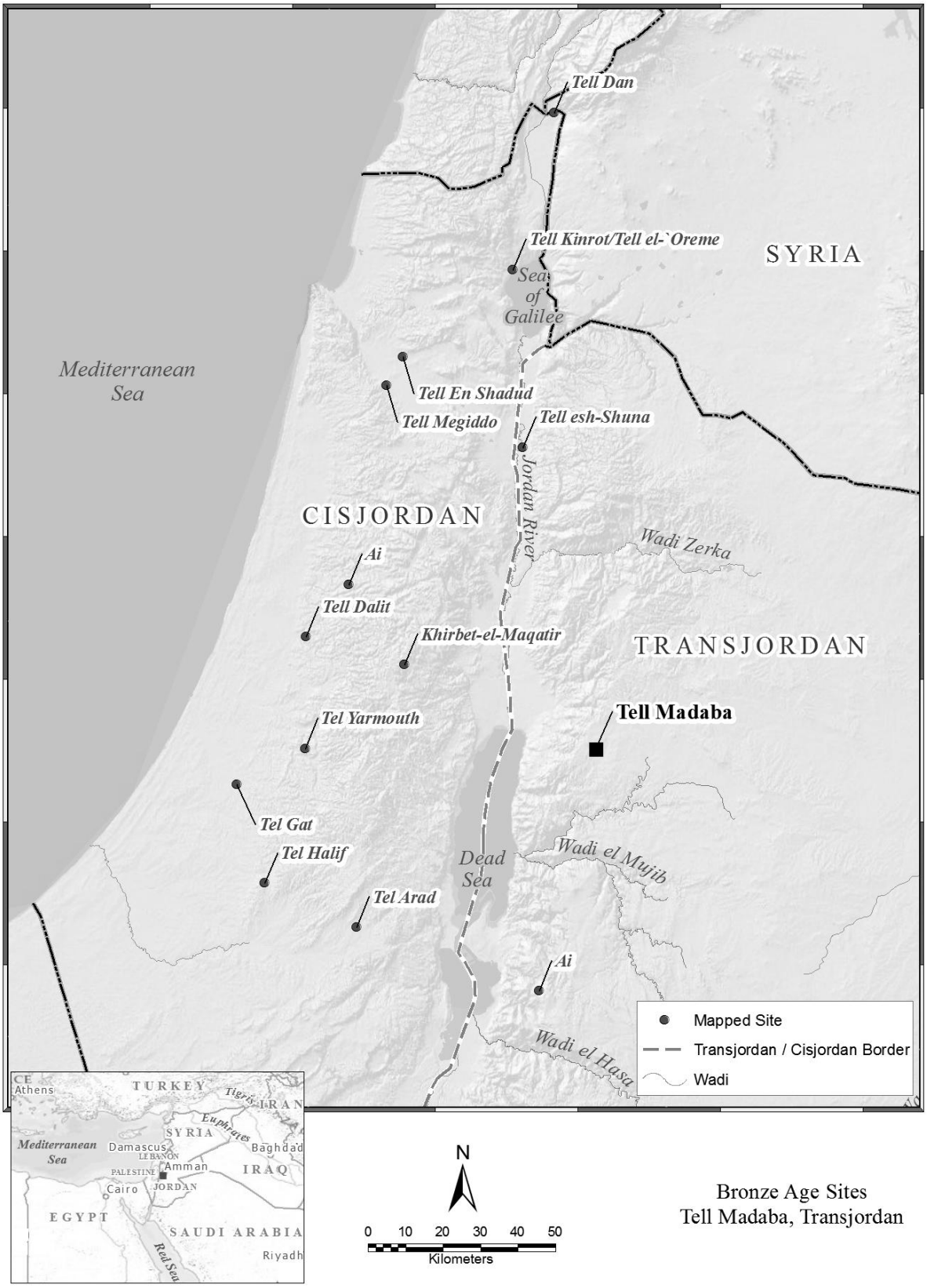
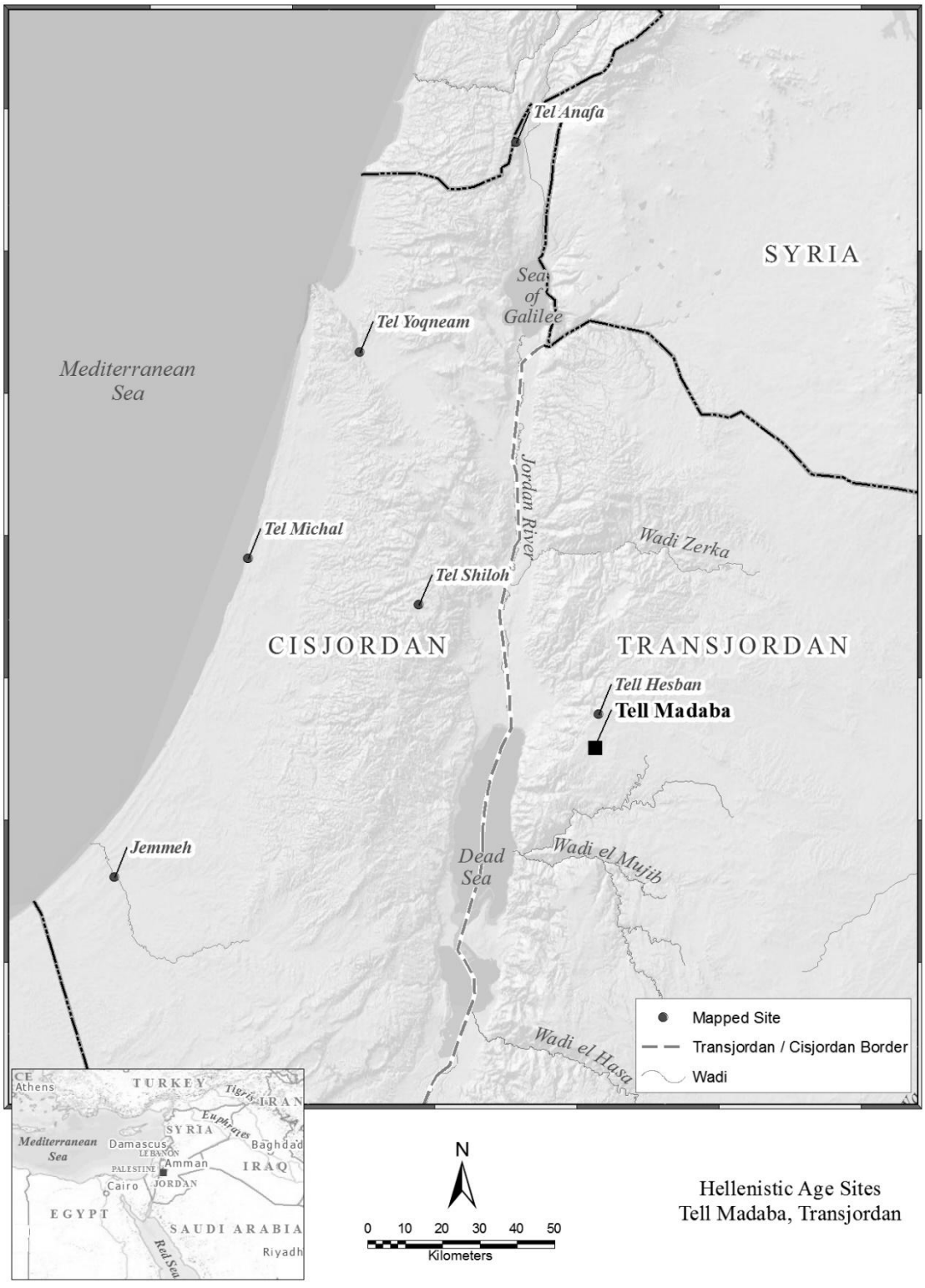
APPENDIX A

Maps showing locations of sites used in regional comparisons

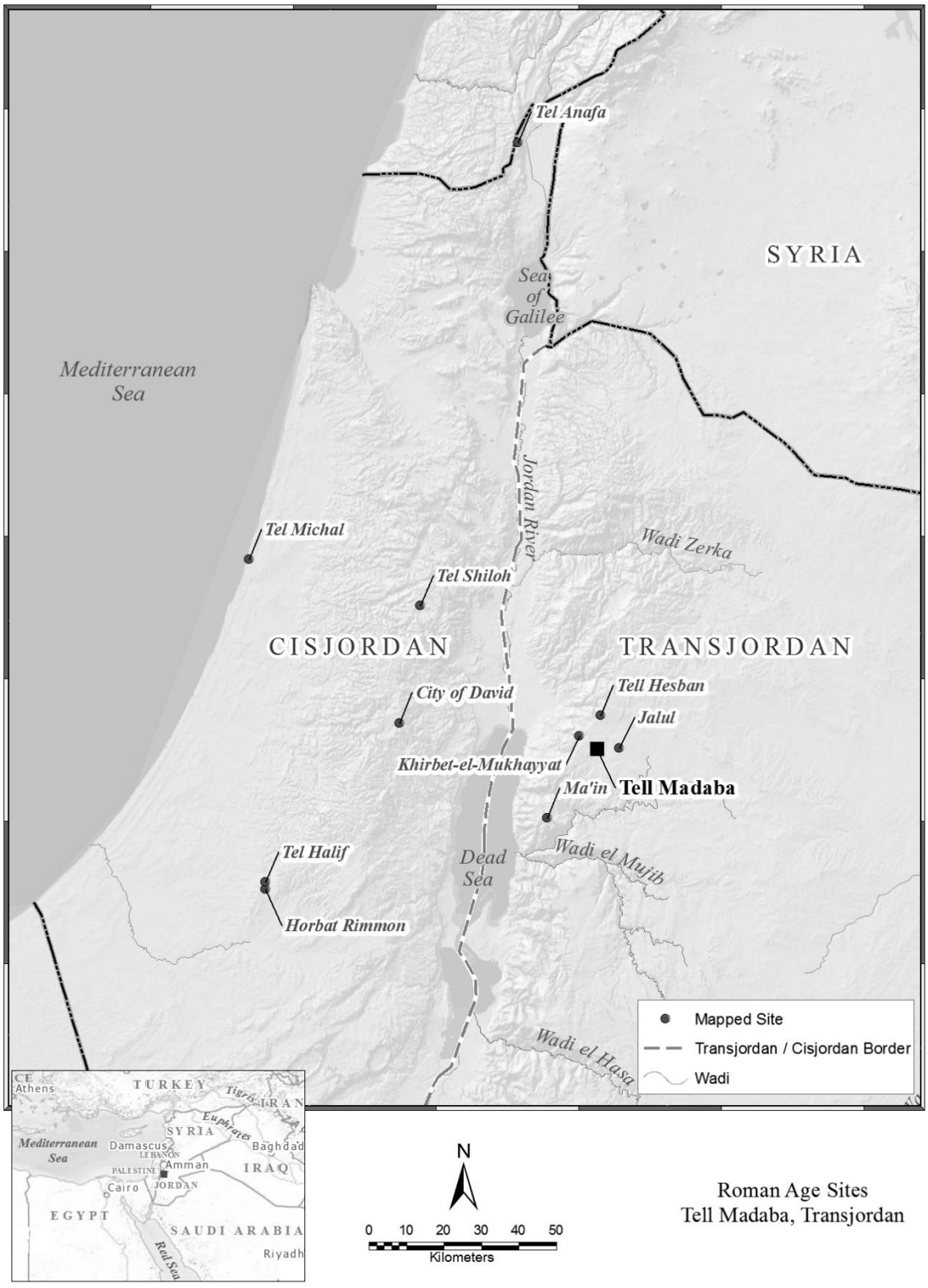


Bronze Age Sites
Tell Madaba, Transjordan

Iron Age Sites
Tell Madaba, Transjordan



Hellenistic Age Sites
Tell Madaba, Transjordan



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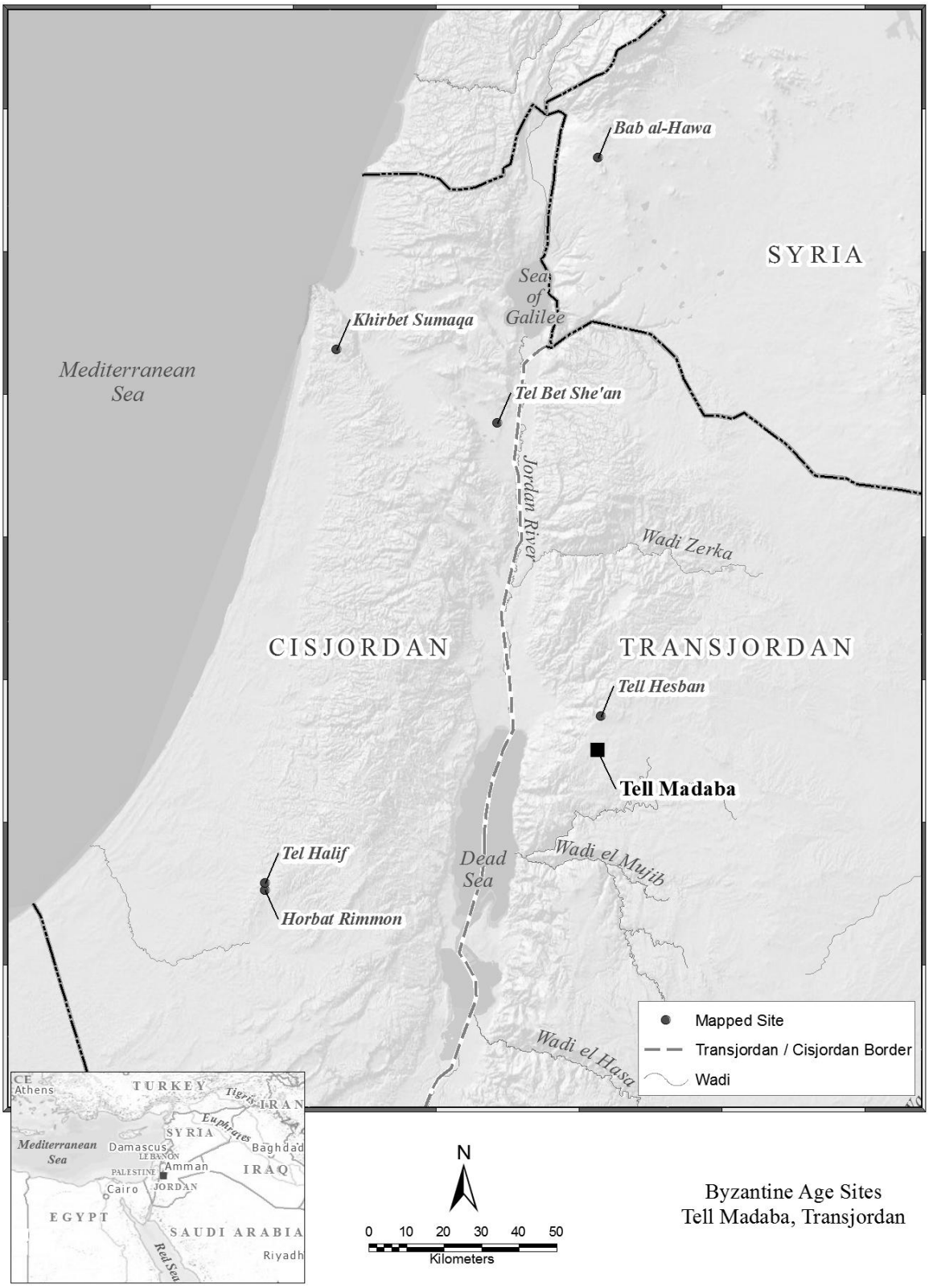
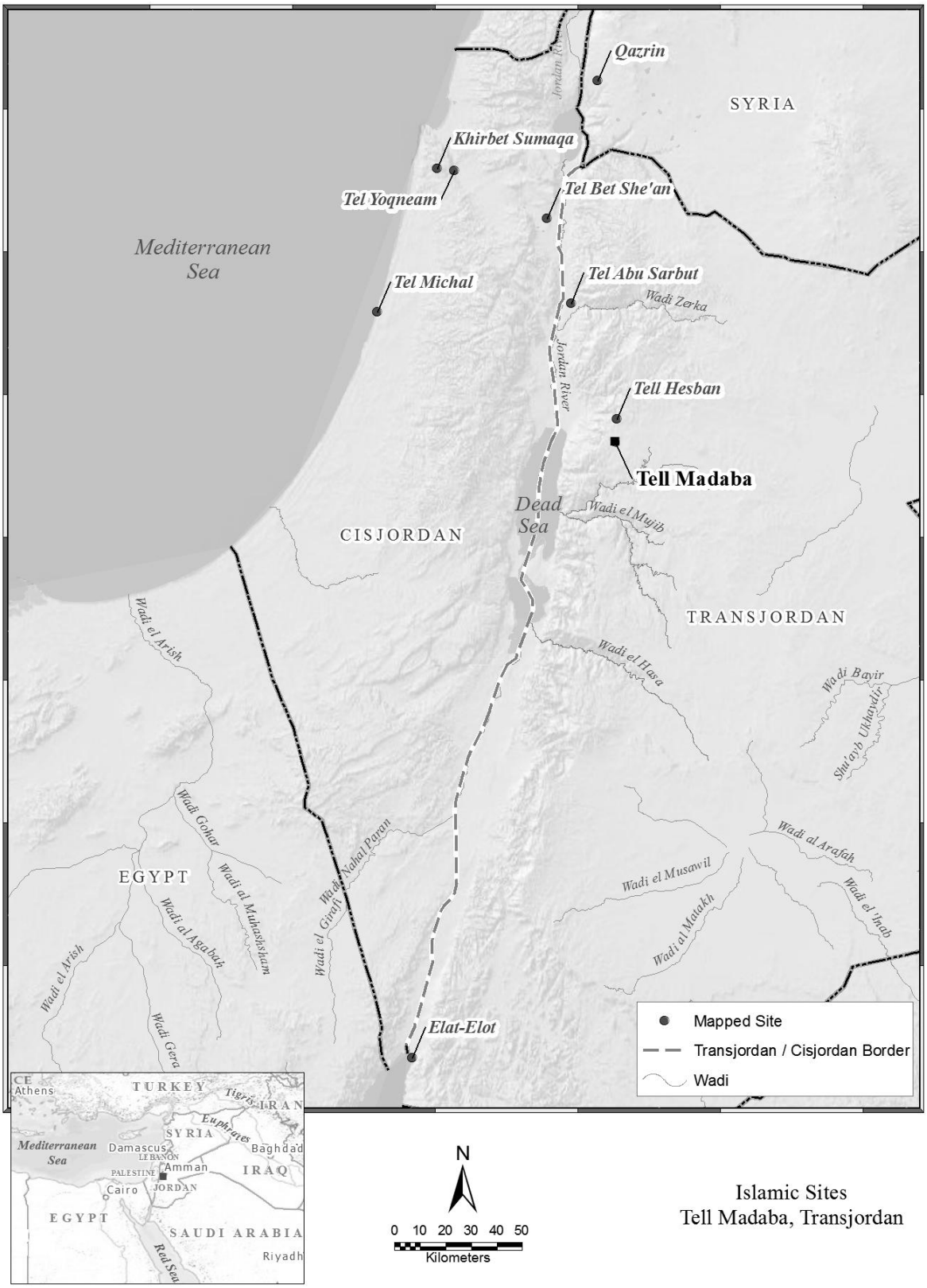


Byzantine Age Sites
Tell Madaba, Transjordan



Islamic Sites
Tell Madaba, Transjordan

APPENDIX B
Tables showing animal distributions throughout the Southern Levant

Bronze Age												
Site	**Region**	**Time**	**No.**	**Sh/Go**	**Sheep**	**Goat**	**Cattle**	**Pig**	**Equid**	**Camel**	**Gazelle**	**Deer**
ez-Zeraqon	Jordan Highlands	EB	9,053	7,069 78%	347 55%	287 45%	1,754 19%	60 <1%	143 2%		20 <1%	7 <1%
Madaba	**Jordan Highlands**	**EB I/II**	**434**	**415 96%**	**30 75%**	**10 25%**	**15 3%**		**3 <1%**		**1 <1%**	
esh-Shuna	Jordan Valley	EB I early	223	111 50%			29 13%	83 37%				
esh-Shuna	Jordan Valley	EB I early	335	177 53%			94 28%	64 19%				
Yaqush	Jordan Valley	EB I	501	343 66%	17 71%	7 29%	100 19%	22 4%	1 <1%		18 3%	17 3%
Yaqush	Jordan Valley	EB II	391	292 73%	18 72%	7 28%	91 23%	4 1%			2 1%	2 1%
Yaqush	Jordan Valley	EB III	340	215 62%	14 74%	5 26%	113 32%	4 1%	1 <1%		2 <1%	5 1%
Me^{c}ona	Galilee	EB I/II	110	72 64%			30 28%	3 3%			5 5%	
Dan	Galilee	EB II/III	184	89 48%	8 57%	6 43%	64 35%	9 5%				22 12%
Kinrot	Galilee	EB	307	188 61%			89 29%	26 8%	3 1%			1 <1%
En Shadud	Jezreel	EB I	150	28 28%		1 100%	21 22%	23 24%	24 25%			
Megiddo	Jezreel	EB I	16,579	2,148 78%	125 73%	47 27%	539 20%	39 1%	4 <1%		27 1%	17 <1%
Megiddo	Jezreel	EB III	3,019	424 69%	33 67%	16 33%	159 26%	25 4%	3 <1%		3 <1%	7 1%
Dalit	Samaria	EBIb-III	1,051	820 78%	more	less	178 17%	4 <1%	9 <1%		28 3%	12 1%
Yarmouth	Hill Country	EB II	216	175 81%			41 19%					
Yarmouth	Hill Country	EB III	959	868 91%			91 9%					
Ai	Hill Country	EB I	244	187 75%	32 74%	11 26%	53 21%	1 <1%	2 <1%		1 <1%	
Ai	Hill Country	EB II	457	397 86%	44 58%	332 42%	54 12%	1 <1%	1 <1%		4 1%	
Ai	Hill Country	EB III	117	100 84%	9 60%	6 40%	14 12%		1 1%		2 2%	
Gat	Hill Country	EB II	783	421* 54%	142 74%	52 26%	158 20%	71 9%	58 7%		38 5%	37** 5%
Halif	Northern Negev	EB III	1,905	NR 93%	NR 63%	NR 37%	NR 6%	NR P	NR P		NR 1%	
Arad	Negev	EB II	185 (M3)	180 97%	50%	50%	3 2%		P (Horse?)		2 1%	

Iron Age II												
Site	**Region**	**Time**	**No.**	**Sh/Go**	**Sheep**	**Goat**	**Cattle**	**Pig**	**Equid**	**Camel**	**Gazelle**	**Deer**
Hesban	Jordan Plateau	Ir II	1,791	1,406 79%	137 62%	83 38%	256 14%	94 5%	29 2%	5 <1%		1 <1%
Madaba	**Jordan Highlands**	**Ir II**	**2,238**	**2,058 92%**	**226 69%**	**102 31%**	**153 7%**	**11 <1%**	**11 <1%**		**4 <1%**	**1 <1%**
Bab el-Hawa	Golan Heights	9th-8th House	350** + Gallus	214 61%			7 25%	6 2%	P		5 1%	38 11%
Tell el-ᶜOreme	Galilee	10th-8th	3,336	1,312 39%	256 56%	199 44%	1,509 45%	66 2%	45 1%	6 <1%	70 2%	328 10%
Dan	Galilee	9th-6th Domest	644	238 37%	28 56%	22 44%	279 43%	4 <1%	18 3%		5 <1%	102 16%
Dan	Galilee	9th-8th Altar	657	448 68%	38 49%	39 51%	170 26%		8 1%		3 <1%	28 4%
Qiri	Jezreel	Ir I/II	970	793 81%	50%	50%	142 17%	14 1%	2 <1%		6 <1%	13 1%
Michal	Coast	10th	366	239 65%			123 34%	3 <1%		1 <1%		
Hamid	Coastal Plain	8/7th	503	274 54%	30 81%	7 19%	193 38	23 5%	6 1%	3 <1%	1 <1%	3 <1%
Ashkelon	Coast	7th	3,451	3,101 90%	423 80%	105 20%	293 9%	19 <1%	20 <1%		13 <1%	5 <1%
Shiloh	Hill Country	Ir II	146	99 68%			41 28%	3 2%				3 2%
City of David	Hill Country	10th	679	574 85%	equal	equal	99 14%	1 <1%	2 <1%		1 <1%	2 <1%
City of David	Hill Country	8th	396 + Gallus?	309 78%	equal	equal	82 21%	2 <1%	1 <1%		1 <1%	1 <1%
Miqne-Ekron	Shephelah	Ir II Str II/III	1,631	1,192 73%	79 61%	50 39%	346 21%	80 5%	10 <1%		2 <1%	1 <1%
Miqne-Ekron	Shephelah	Ir II Str Ic/Ib	1,042	736 70%	93 78%	37 22%	271 26%	19 2%	10 1%		1 <1%	5 <1%
Jemmeh	Southern Coast	8th/7th	1,059	845 80%	110 80%	27 20%	131 12%	11 1%	19 2%	48 5%	5 <1%	
Halif	Northern Negev	Ir II	1,087	NR 84%	NR 66%	NR 34%	NR 15%	1 <1%	1 <1%			20 <1%
Horvat Qitmit	Negev	Ir II Edom Cult	321	298 93%			23 7%					

Hellenistic Site												
Site	**Region**	**Time**	**No.**	**Sh/Go**	**Sheep**	**Goat**	**Cattle**	**Pig**	**Equid**	**Camel**	**Gazelle**	**Deer**
Michal	Coast	Hellen	489	327 67%			144 29%		12 2%	6 1%		
Shiloh	Hill Country	Hellen	100	62 62%			32 32%	1 1%	1 1%			4 4%
Yoqneam	Mount Carmel	Hellen	94	25 27%			51 54%	15 16%	1 1%	1 1%	1 1%	
Jemmeh	Southern Coast	Hellen	2898	1965 68%	190 75%	65 25%	681 23%	21 <1%	56 2%	172 6%	3 <1%	
Anafa	Galilee	Hellen	462	203 44%	12 80%	3 20%	162 35%	57 12%	10 2%		2 <1%	28 6%
Hesban	Jordan Plateau	Late Hellen	1138	977 86%	135 64%	75 36%	136 12%	6 <1%	4 <1%	15 1%		
Madaba	**Jordan Highlands**	**Late Hellen**	**689**	**601 87%**	**34**	**41**	**37 5%**	**13 2%**	**37 5%**	**1 <1%**	**1 <1%**	

Roman

Site	Region	Time	No.	Sh/Go	Sheep	Goat	Cattle	Pig	Equid	Camel	Gazelle	Deer
Michal	Coast	Hasmo Roman	346	225 65%			111 32%	6 2%	2 <1%	2 <1%		
Horbat Rimmon	Shephelah	Early Roman	93 + Gallus	81 87%			11 12%	1 1%				
City of David	Hill Country	Early Roman	980 + Gallus	688 70%	equal	equal	284 29%		1 <1%			7 1%
Hesban	Jordan Plateau	Roman	3309	2574 78%	207 58%	151 42%	417 13%	226 7%	68 2%	24 <1%		
Anafa	Galilee	Roman	683	318 47%	25 86%	4 14%	186 27%	138 20%	5 1%	1 <1%	1 <1%	34 5%
Shiloh	Hill Country	Roman	150	113 75%			31 21%	4 3%				2 1%
Khirbet Ibreiktas	Coast	Late Roman Well	124 + Gallus	54 44%			19 15%	1 <1%	50 40%			
Madaba	**Jordan Highlands**	**Roman**	**2332 + Gallus**	**2195 94 %**	**147 51%**	**142 49%**	**60 3%**	**14 <1%**	**50 2%**	**3 <1%**	**12 <1%**	**1 <1%**

Byzantine Period												
Site	**Region**	**Time**	**No.**	**Sh/Go**	**Sheep**	**Goat**	**Cattle**	**Pig**	**Equid**	**Camel**	**Gazelle**	**Deer**
Khirbet Sumaqa	Mount Carmel	Roman Byz Synagogue	65 (tot) many birds	28 80%			3 9%			4 11%		
Khirbet Sumaqa	Mount Carmel	Roman Byz Dwelling	68	18 28%			46 71%					1 1%
Halif	Northern Negev	Roman Byzantine	724	NR 72%			NR 26%	NR 1%	3 <1%		2 <1%	
Horbat Rimmon	Shephelah	Byzantine	280 + Gallus	280 89%	248		31 11%		1 <1%			
Hesban	Jordan Plateau	Byzantine	1301	932 72%	58 55%	48 45%	162 12%	130 10%	63 5%	14 1%		
Bab el-Hawa	Golan Heights	Byzantine	3066	2147 68%	More	Less	496 14%	NR 6%	192 5%		43 1%	188 5%
Bet She'an	Jordan Valley	Byzantine	6000*	52%			32%	13%	2%	<1%	<1%	
Madaba	**Jordan Highlands**	**Byzantine**	**93 + *Gallus***	**83 89%**	**3**		**1 1%**	**4 4%**	**5 5%**			

Late Byzantine/Early Islamic												
Site	**Region**	**Time**	**No.**	**Sh/Go**	**Sheep**	**Goat**	**Cattle**	**Pig**	**Equid**	**Camel**	**Gazelle**	**Deer**
Bet She'an	Jordan Valley	Byzantine E. Islamic	6,000*	61%			10%	17%	6%	6%		
Yoqneam	Mount Carmel	Early Islamic	608 + Gallus	264 43%			295 49%	13 2%		32 5%	1 <1%	3 <1%
Elat-Elot	Negev	Early Islamic	178	138 77%	9 100%				1 <1%	39 22%		
Michal	Coast	Early Islamic	89	52 58%			36 40%			1 1%		
Bet She'an	Jordan Valley	Ummayad	6,000*	55%			15%	25%	1%	4%		
Bet She'an	Jordan Valley	Abbasid Ubbayid	6,000*	48%			38%	3%	6%	2%	3%	
Yoqneam	Mount Carmel	Crusader	347 + Gallus	196 56%			126 36%	17 5%	1 <1%	6 2%		1 <1%
Abu Sarbut	Jordan Valley	Ummayad Mamluk	3,105	1,269 41%	114 39%	178 61%	1,327 43%	5 <1%	191 6%	271 9%	15 <1%	27 1%
Qazrin	Golan	Mamluke	623 + Gallus	259 42%	26 76%	8 24%	312 50%		35 6%	10 2%	6 1%	1 <1%
Hesban	Jordan Plateau	Mamluk	8,429	6,901 82%	353 47%	402 53%	1,117 13%	139 2%	57 <1%	215 3%		
Bet She'an	Jordan Valley	Mamluk	6,000*	18%			27%	2%	46%	7%	<1%	
Khirbet Sumaqa	Mount Carmel	Mediaeval Cistern	226 (tot)	138 63%			47 21%	17 8%	12 5%	4 2%		1 <1%
Madaba	**Jordan Highlands**	**Late Byz/Early Islamic**	**226 (tot)**	**177 86%**	**20 56%**	**16 44%**	**6 3%**	**19 9%**	**3 1%**	**4 2%**		**1 <1%**